Perspective 2000

manitoba hydro

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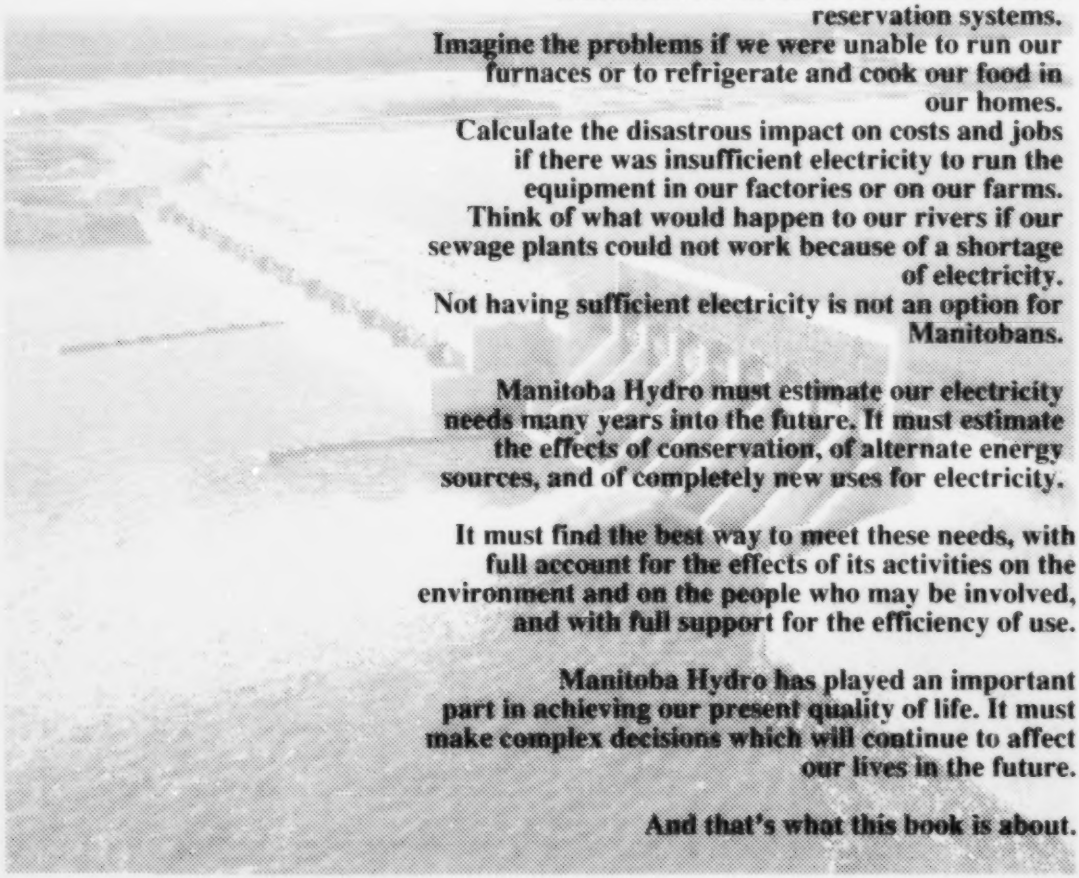
Electricity is vital to the quality of life in Manitoba. Electricity lights our streets and heats our homes. Electricity powers our farms and factories. Electricity is essential to modern medicine, education, recreation and security. We cook with it, refrigerate with it, compute with it. It controls our traffic and washes our clothes. We sew with it, saw with it, print with it, pump with it.

As much as we are concerned about having clean air to breathe and decent water to drink, we should also be concerned about having enough electricity to meet our needs.

Think about the frustration of being unable to receive a favorite program, or the chaos of getting around without traffic lights.

Consider the inconvenience of extended interruptions to the users of elevators in high rise buildings. To the users of automatic banking machines. To the users of airline or hotel reservation systems. Imagine the problems if we were unable to run our furnaces or to refrigerate and cook our food in our homes. Calculate the disastrous impact on costs and jobs if there was insufficient electricity to run the equipment in our factories or on our farms. Think of what would happen to our rivers if our sewage plants could not work because of a shortage of electricity. Not having sufficient electricity is not an option for Manitobans.



Manitoba Hydro must estimate our electricity needs many years into the future. It must estimate the effects of conservation, of alternate energy sources, and of completely new uses for electricity.

It must find the best way to meet these needs, with full account for the effects of its activities on the environment and on the people who may be involved, and with full support for the efficiency of use.

Manitoba Hydro has played an important part in achieving our present quality of life. It must make complex decisions which will continue to affect our lives in the future.

And that's what this book is about.

manitoba hydro

Mission Statement

The Manitoba Hydro Act states:

"The intent, purpose, and object of this Act is to provide for the continuance of a supply of power adequate for the needs of the province, and to promote economy and efficiency in the generation, distribution, supply, and use of power."

Manitoba Hydro will interpret this legislated mandate within the context of contemporary values of society and will be responsive to policy direction from the government of Manitoba.

Strategic Objectives

Achievement of the Corporate Mission depends upon the balanced pursuit of several strategic objectives.

Manitoba Hydro's strategic objectives are:

- **To provide a safe, adequate, economical and reliable supply of electricity to meet customer requirements.**
- **To provide all customers with excellent service with particular focus on individual customer satisfaction.**
- **To promote conservation of electricity when it can be achieved more economically than supply.**
- **To develop and maintain a workforce with a high level of motivation, productivity and job satisfaction.**
- **To improve productivity and quality in all segments of the business on a continuing basis.**
- **To be recognized as a good corporate citizen which deals sensitively and fairly with the effects of its activities on communities and individuals.**
- **To conduct all corporate activities in accordance with the principles of sustainable development.**
- **To assure the Corporation's long-term financial integrity.**
- **To secure beneficial extra-provincial agreements.**

MANITOBA HYDRO

OFFICE OF THE PRESIDENT

P.O. BOX 815 · WINNIPEG, MANITOBA, CANADA R3C 2P4

January, 1990

Dear Reader:

Your provincial electric utility is an important business in Manitoba. Its directions and its strategic decisions are matters of concern to customers, suppliers, government — indeed all Manitobans.

Given the complexity of factors surrounding these decisions, some concerns are understandable and deserve greater explanation than is possible in our annual report.

Perspective 2000 is intended to explain, in largely non-technical terms, the context in which corporate activities take place and to help indicate our focus for the future.

I hope you will find these pages interesting and informative. If you have questions or suggestions, I encourage you to discuss them with your local Manitoba Hydro representative or the closest Regional office. Their telephone numbers are shown on page 2.

Alternatively, I invite you to write to me directly with your comments.

Sincerely,

Garry H. Beatty
President & Chief Executive Officer

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Manitoba Hydro is the Crown Corporation responsible for the supply of electricity in Manitoba, now and into the future.

1.1 Perspective 2000

Perspective 2000 is intended to describe and explain, within a single volume, the pressures and influences Manitoba Hydro faces, and how it plans to respond to them over the next decade.

The title was chosen in part because 1999 represents the end of Manitoba Hydro's short-term planning horizon.

A 10-year short term may seem a bit of a misnomer, but the reality is that Manitoba Hydro's major decisions revolve around the need for new facilities. These facilities have useful lives of 40 to 100 years, and often involve lead times of up to 10 years. That is, decisions sometimes have to be made today to satisfy predicted conditions in 10 years time, and these decisions are often conditioned by expectations of events well beyond the next decade.

Perspective 2000 is intended primarily for the power consumers of Manitoba, but it is anticipated that the information contained herein will be valuable to all those who do business with the Corporation—customers, suppliers, legislators, regulators and others.

Manitoba Hydro functions in a very complex and dynamic environment, and is often in the forefront of the important issues that confront modern industrial societies. Perspective 2000 sets out to explain some of these issues, and to provide a focal point for further discussion. In general terms, it will illustrate how the various factors are brought into major Corporate decisions, and it will discuss the types of options available. It will also outline the current preferred directions, and include a discussion of the risks and benefits of the chosen route.

Of necessity, the material contained within Perspective 2000 is at a summarized level. A degree of caution is advised therefore in interpreting some of the content. For reasons of clarity and ease of presentation, much detail has been omitted. Also, readers should note that Manitoba Hydro operates in a continually changing environment. Events since the date that this book was sent to press may well have overtaken some items.

Similarly, caution must be exercised when assessing possible future events. As will become evident throughout this document, a large number of assumptions have to be made regarding a wide range of future conditions. In any prediction of the future, there is a degree of uncertainty, and a change in any of the major assumptions or predictions will likely result in a different conclusion, and possibly a different course of action.

Prudent planners therefore, while planning to meet the expected course of events, will try to maintain options in case the expected doesn't happen. They will also regularly re-assess the situation to confirm they are on the right course, or to change if necessary.

It is Manitoba Hydro's intention therefore to review the currency of Perspective 2000 and to revise and re-issue it when circumstances warrant.

1.2 Mandate

Any Corporation's plan for the future must start with its mandate and its vision of itself achieving that mandate.

In Manitoba Hydro's case, its basic mandate is set out in legislation, with further elaborations and interpretation being the responsibility of The Manitoba Hydro Electric Board. These are presented as the Corporate Mission Statement and Strategic Objectives on page 4.

A basic assumption regarding the future, and one that is inherent throughout Perspective 2000, is that this mandate will not materially change.

Manitoba Hydro will continue to be responsible for the supply and delivery of electricity throughout the province, with the exception of the central part of the City of Winnipeg, where Winnipeg Hydro operates.

With this mandate, and because the provision of a secure and reasonably priced supply of electricity is essential to the quality of life and economic development of Canadian society, a fundamental assumption underlying all Corporate action is that its customers' requirements for electrical power must be served.

Manitoba Hydro's activities are extensively shaped by outside influences. This section describes the more significant aspects of both the business and the natural environments, insofar as they affect the Corporation.

While the major emphasis is on the future, some historical information is included as a basis upon which to evaluate trends and directions.

Most importantly, this section outlines the major assumptions regarding the Corporation's future business environments, and it illustrates the Corporation's sensitivity to deviations from these assumptions.

2.1 Corporate Environment

The legislative framework within which Manitoba Hydro must operate is a critical element.

As a Crown Corporation, it was established by the Manitoba Legislature. The enabling legislation prescribes a significant degree of autonomy and independence in its business dealings, and the marketplace dictates that it behave in many respects as a normal commercial entity.

This leads to a complex pattern of legislative, regulatory and competitive influences upon the Corporation.

2.1.1 Legislation

Manitoba Hydro is established by the Manitoba Hydro Act, and a member of the provincial cabinet is designated as Minister Responsible for the Administration of the Manitoba Hydro Act. Cabinet appoints the Chairman and Members of the Board, and confirms the appointment of the President and C.E.O.

Every year the Corporation must prepare an Annual Report, and present it to the Minister, who in turn must lay it before the legislative assembly.

2.1.2 Regulation

Manitoba Hydro is a regulated corporation in that the rates which it charges for electricity are subject to review and approval by The Public Utilities Board. In addition, the Corporation is subject to all the laws of Manitoba and generally obtains all the permits and licences which a private enterprise would require for the same undertaking. These include Water Power Licences, licences under The Environment Act, Water Rights Licences, vehicle licences, building permits, and even beverage room licences at the construction camps.

Stringent controls have been placed on the location and routing of transmission lines, substations and other facilities, and substantial public participation is sought and obtained prior to a construction licence being issued. As our society becomes more complex, the range of these types of regulation is expected to increase.

2.1.3 Trading and Commerce

The sale of electrical energy between utilities has traditionally been free trade in the truest sense—willing

buyer, willing seller, tax and duty free. At the retail level, however, trade is restricted in that utilities have traditionally been limited to prescribed geographic areas, and obligated to serve the customers in that area.

Manitoba Hydro does not expect any significant changes to either its retail service area in Manitoba, or to its wholesale transactions with the utilities responsible for retail sales in the service areas in adjacent provinces and states.

The Canada-U.S. Free Trade Agreement (FTA) which came into effect on January 1, 1989, is not expected to have a significant impact on electricity transactions between utilities in the two countries in the foreseeable future. The only immediate effect may be to reinforce the overall positive view of cross-border exchanges in light of the closer trading relationship between the two countries.

The FTA does promise some benefits of a general nature. The spirit of the Agreement will provide a counter-pressure against U.S. protectionist measures and the potential for export sales will be increased.

It is expected that contract provisions will continue to safeguard the security of supply for Manitoba customers.

As purchasers of goods and services, publicly owned utilities are instruments of local government economic policies and there are some consequent restrictions on the interprovincial and international flow of goods. In early 1989, the provinces of Manitoba, Saskatchewan, Alberta and British Columbia signed a "Memorandum of Agreement on the Reduction of Interprovincial Trade Barriers in Western Canada: Government Procurement." While this agreement specifically excluded crown corporations, Manitoba Hydro is currently discussing with its counterparts in these provinces, the possibility of an equivalent agreement covering the electrical utility industry.

Manitoba Hydro anticipates that, as a result of these and other initiatives, trading restrictions will be generally reduced.

2.2 Energy Environment

A secure and reasonably priced supply of energy is essential for any nation to assure a continued and improving quality of life for its citizens. The politics and economics of energy, therefore, on a global basis, are extremely complex, and the situation is always changing as various groups try to gain an advantage.

Manitoba Hydro is a small player in this global scene but is very directly and immediately affected by it. The following section briefly describes the current energy supply situation in Manitoba, some of the international events that might affect that situation, and Manitoba Hydro's expectation for the future.

2.2.1 Energy Availability & Pricing

The majority of energy consumers do not see themselves as buying energy. They normally consider themselves to be buying heating or cooling, or lighting, or some other amenity to improve the quality of their lives or the profitability of their businesses. They see the energy they consume as merely the means to that end. In fact many of these ends can be achieved by a number of different sources of energy, and customers choose between them on the basis of availability, reliability, price, convenience and other similar factors.

Certain fuels lend themselves to certain uses, and while there is evidence that availability, consumption and prices are linked—the classic law of supply and demand—there is little evidence that there is a trend to switch. For example, fuel oils are overwhelmingly the fuel of choice for transportation, and electricity is overwhelmingly that for lighting, household and commercial appliances, and so on. While there are some exceptions (e.g. propane-powered vehicles) in quantitative terms, these are insignificant today.

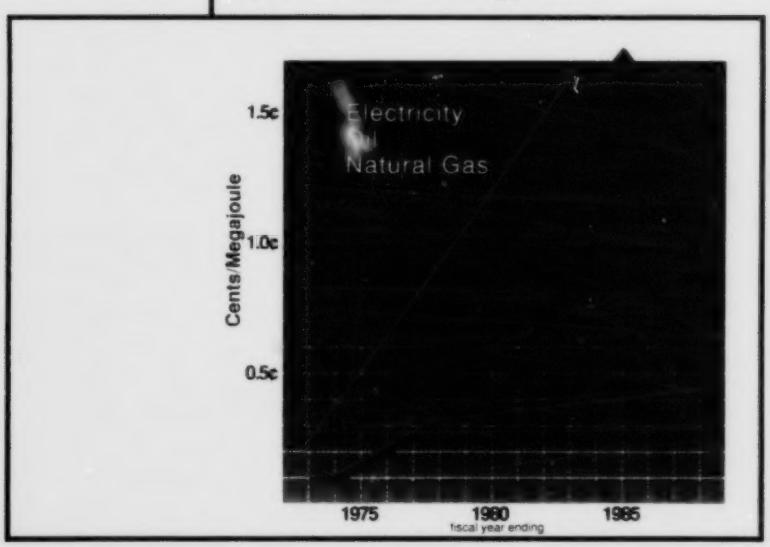
There are other energy uses, however, where the various fuels compete "head-to-head". In Manitoba, the most important of these uses is the provision of heat—space heating in residential, industrial and commercial buildings, and process heat in industry.

Figure 2.1 shows the equivalent prices of electricity, natural gas and oil when used to heat a house in Winnipeg since 1973. The figure clearly illustrates the volatility of energy prices; this volatility can be related directly to government initiatives of various countries.

The 1973 OPEC oil embargo, followed by a second round of production cutbacks in 1979, caused dramatic increases in the price of oil. In 1985, the price started to drop because some OPEC members did not constrain production and because of increased competition from non-OPEC nations.

Historically, natural gas prices increased as demand increased and because of the National Energy Program which tied the price of natural gas to the price of oil. In the mid 80's, natural gas prices levelled off and then dropped because of deregulation of the industry in both Canada and the United States, and because of

figure 2.1 ***Historic Energy Prices***



lower world oil prices and excess natural gas production capacity.

The price of electricity increased throughout the 1970s, but was frozen in Manitoba from February 1979 until May 1983 by the provincial government. Since the price freeze ended, electricity rates have increased steadily in response to production costs.

Both oil and natural gas are currently available worldwide in abundance, which is reflected in their currently stable prices. In Manitoba locations where natural gas is available, and all other things such as convenience being equal, it is the most economical heating fuel. Where natural gas is not available, which is basically all of Manitoba more than 30 kilometers away from the main west-to-east pipeline in southern Manitoba, electricity is the fuel of choice.

Other sources of energy, such as biomass, wind and solar, are not significant in Manitoba at present. There is a limited amount of solar heating—mostly supplementary and mostly for water—and wood is often used for heating in rural and northern areas.

Coal, while plentiful in North America, is not indigenous to Manitoba, and is not currently a practical or viable fuel in the province.

2.2.2 International Issues

There is a growing awareness of the fragility of the relationship between economic growth, energy consumption, and environmental protection. In March 1987, the United Nations published the so-called 'Brundtland Report', named after the leader of the Working Group (Gro Brundtland, Prime Minister of Norway) which popularized the concept of sustainable development throughout the world.

Briefly stated, sustainable development implies a change in habits, on a global basis, to ensure that economic growth is not achieved at the price of environmental degradation.

Since the exploitation and consumption of energy is a key element in this linkage, it is clear that as the concept takes hold, and any associated behavioral changes start, there will be significant implications for companies, such as Manitoba Hydro, in the energy business.

Both the Federal and Provincial governments have responded to the Brundtland report with policy initiatives and technical studies. Manitoba Hydro maintains a close working relationship with the people involved in this work.

While the scope of all of these studies and initiatives is very wide ranging, there are three aspects which have particular significance to Manitoba Hydro.

The burning of fossil fuel as an energy source creates nitrogen oxides (NO) and sulphur dioxide (SO_2) emissions which contribute to acid rain, and carbon dioxide (CO_2) which is believed to be contributing to a global warming effect. Actions to reduce these emissions, would increase the relative attractiveness of hydroelectric energy.

The second aspect is that of more efficient utilization of the energy that is available. Manitoba Hydro currently incorporates a degree of conservation into its planning activities; however, if North American con-

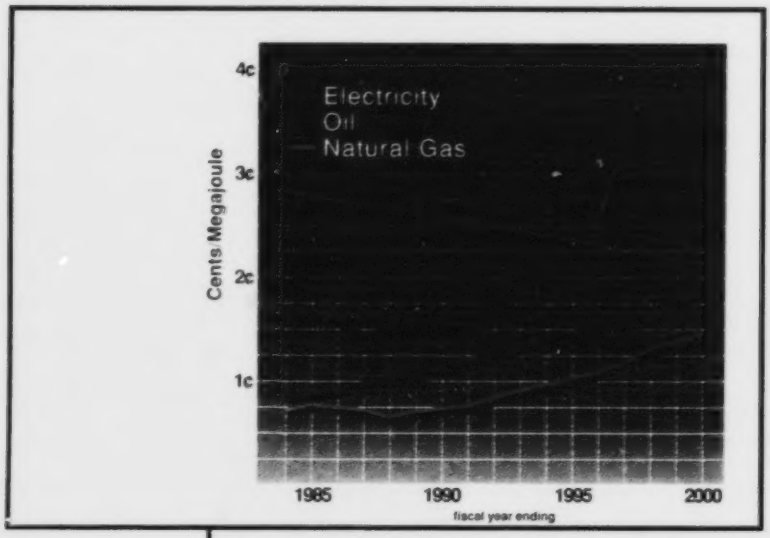


figure 2.2 ***Expected Future Energy Prices***

sumers become significantly more conservation-conscious, a scenario involving lower energy growth rates would unfold.

The third point of significance to Manitoba Hydro is the extent and ramifications of climate changes, if any, resulting from industrial activities.

These three aspects illustrate the repercussions that world events may have upon Manitoba Hydro's activities.

Another concern, with potentially serious ramifications, pertains to the worldwide supply-and-demand balance of oil. Should the current situation in the Near and Middle East degenerate, or something else happen to create another oil crisis, then all of Manitoba Hydro's projections and presumptions would require re-evaluation.

2.2.3 Future Expectations

Manitoba Hydro's expectation of the future energy environment, and the basis for all planned activities, is that it will be relatively stable.

It is anticipated that adequate quantities of gas and oil will continue to be available, but that the prices of gas and oil will increase relative to the price of electricity. Predicted relative prices for home heating, which were shown historically in Figure 2.1, are shown in Figure 2.2.

North American society is expected to become more energy efficient, but this will be a gradual change. The change will be driven more by economic advantage than by any altruistic reason, but it will be encouraged by a common desire to reduce the volume of harmful waste products such as CO_2 and acid rain gases.

Overall energy consumption in the province is expected to increase about 24% by the year 2000, with electricity's market share increasing from its current 22.6% to 23.7%. This is illustrated in figure 2.3.

Specific assumptions regarding future conditions are explained elsewhere. Generally speaking, Manitoba Hydro foresees a future where:

–customers expect, and are provided, a wider variety of options in serving their energy needs;

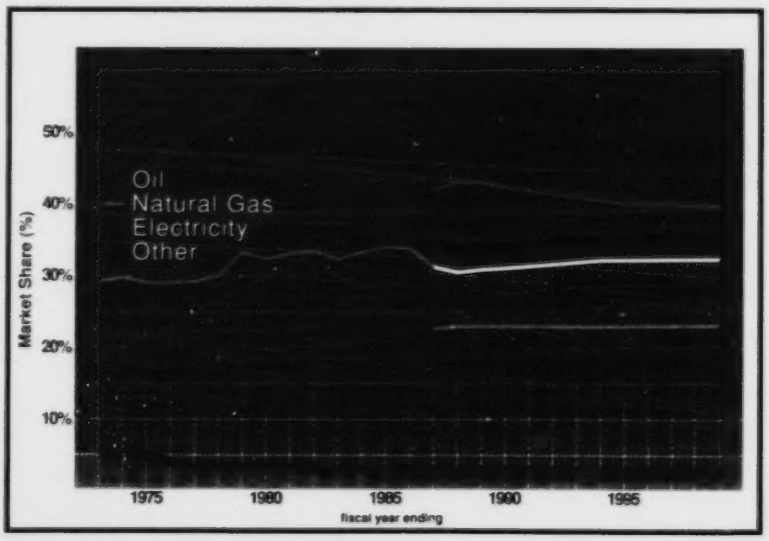
–interprovincial and international trade in energy increases and is less regulated;

–all suppliers of energy will offer an extremely high level of service, reliability and quality;

–there will be a trend towards a conserver society, slow but steady;

–the major competitive advantage will be with the least-cost supplier.

figure 2.3 ***Manitoba Final Energy Demand***



2.3 Economic Environment

Although Manitoba Hydro is itself a direct contributor to the Manitoba economy, the state of the Manitoba economy has a marked effect upon Manitoba Hydro. Energy consumption, the ability to acquire goods and services, the prices paid for these goods and services, the wages paid to employees, and many other factors are all influenced by the level of economic activity within the province.

Expectations of future economic activity, therefore, shape expectations of future Corporate activities.

2.3.1 Provincial Economy

The level of economic activity in Manitoba, as measured by real gross domestic product is projected to expand at a 2.5% annual real rate over the next 20 years. This is down from the 3.3% average rate experienced during the 1961-88 period. The Canadian economy is expected to perform marginally better at an annual rate of 2.7% during the same period, compared to 4.3% during the 1961-88 period. See Figure 2.4.

Economic growth in Manitoba has been primarily in the service sector. While growth in the goods-producing sector has increased an average of 8.8% per year over the last 27 years, the service sector has increased at 9.9% per year.

As a result, the service component of the economy has increased from 67% to 72%, while the goods-producing component has decreased from 33% to 28%. This trend is expected to continue, with a further 4% to 5% shift over the next 10 years, as shown in Figure 2.5.

This change is reflected in employment patterns. During the last decade, total employment grew by 53 000 jobs. However, the service sector grew by 58 000 while the goods-producing sector lost 5 000. (The fact that the goods-producing sector is growing while employment in the sector is decreasing indicates a steady increase in productivity in the sector, a feature that is expected to continue.) While an average of 5 250 net new jobs are expected to be created each year for the next 20 years, virtually all of them will be in the service sector.

Inflation is anticipated to remain in the 4% to 5% range until the mid 1990s. This relatively low inflationary growth is tied to low economic growth. However, as North American energy prices start to escalate, and lower labor force growth combined with an aging population puts pressure on wage demands, higher inflationary pressures are expected in the late 1990's.

Manitoba's economy is expected to remain sufficiently diversified that it will not suffer or benefit to extremes under varying economic conditions. For example, the disastrous year experienced by the agricultural sector in 1988 was offset by a record year in the mining and metals sector.

However, the provincial economy is not totally immune to economic changes elsewhere, and major recessions or expansions are reflected in Manitoba.

The future economic factors described here can be considered to form the most likely scenario. Alternative scenarios are also evaluated because, while less likely, they can occur. The high, or expansion scenario considers average annual increases in the gross domestic product of 3.3%. The low, or recession scenario, supposes a 1.3% per year average growth.

Manitoba Hydro's predictions have been developed in consultation with other forecasters working in the field, and are generally consistent with the majority.

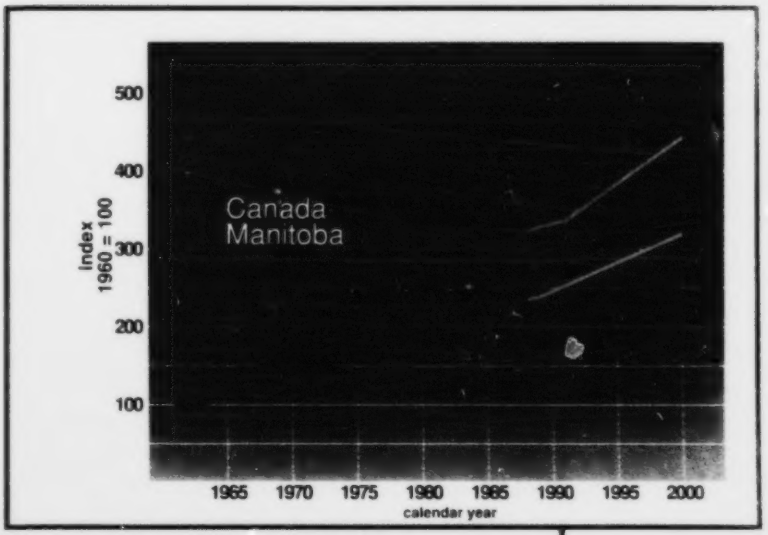
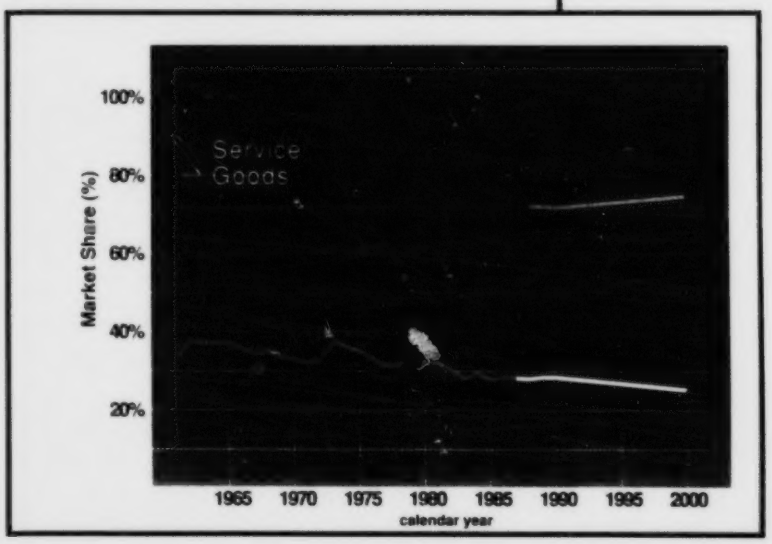


figure 2.4 ***Real GDP Growth Index***

figure 2.5 ***Manitoba Economy, Goods and Service Producing Sectors***



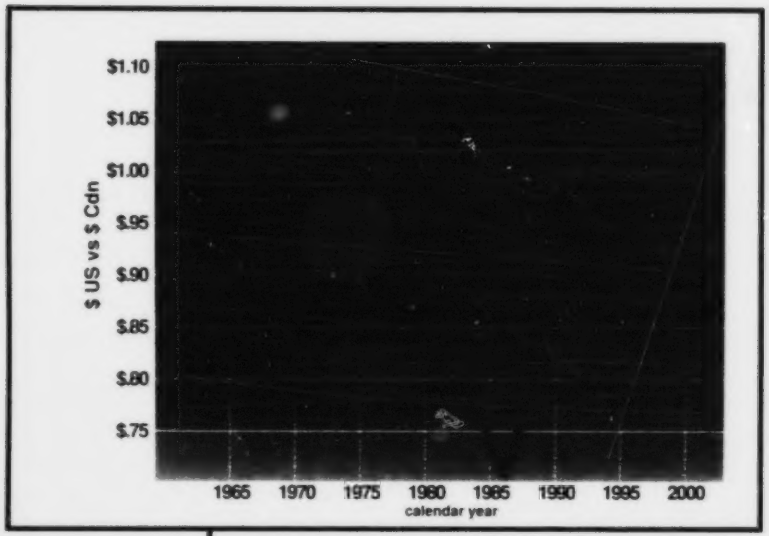
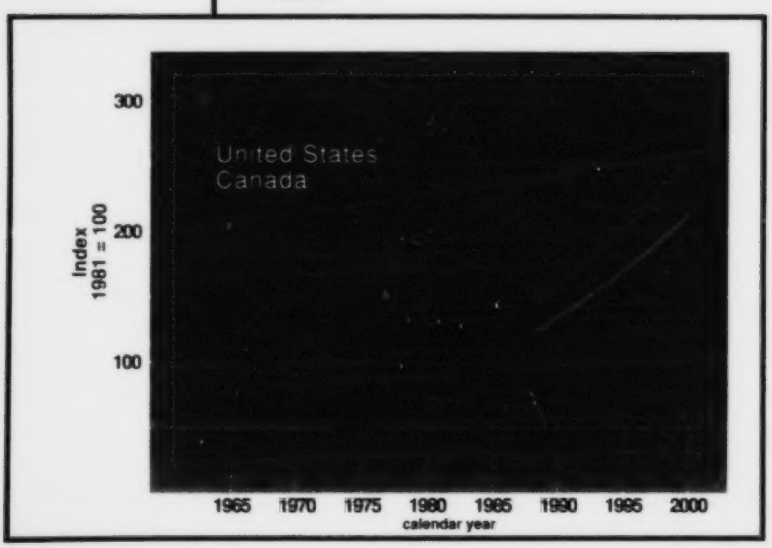


figure 2.6 ***Canada - U.S. Exchange Rate***

figure 2.7 ***U.S. and Canada Cumulative Inflation***



2.3.2 Demographic Changes

The Manitoba population is expected to increase at an annual rate of 0.4% during the next 20 years, compared to an annual rate of 0.6% in the past 27 years. This lower population growth is predicted because of lower fertility rates, higher net out-migration, and higher death rates.

The lower fertility rates are tied to higher incomes, higher education, and the increasing participation of females in the work force. Annual births are expected to fall from the current 17 000 to about 14 000 in 2008, while deaths are expected to increase from the current 9 000 level to 10 000 annually. Net out-migration will be high until the early 1990s when the Ontario economy is expected to slow down. In the medium term, net out-migration should increase to 2 000 people annually and then fall to zero net out-migration by the year 2008.

The net population increase will be approximately 5 000 people per year over the next decade. This population growth combined with a growing trend towards smaller households will result in a household growth rate slightly higher at 5 200 per year. It is anticipated that 70% of all of new residential development will be in urban areas, such as Brandon, Thompson, Portage la Prairie and Winnipeg, and that some 40% of all new dwelling units will be apartments or the equivalent.

2.3.3 Monetary and Financial Factors

As a large borrower, Manitoba Hydro is directly affected by interest rates. Also, since much of this borrowing is done in the U.S. bond market, and many of the Corporation's export sales transactions are in U.S. dollars, Manitoba Hydro is concerned with U.S./Canadian exchange rates.

Historically, the Bank of Canada has pegged the short-term interest rate at 1.5% to 2.0% higher than its U.S. counterpart to attract and maintain capital in Canada. Given that the U.S. interest rates will be relatively high due to their large national and personal debt, Canadian interest rates are expected to remain in the 10.0% to 10.5% range. Inflation is expected in the 4.0% to 5.0% range.

The value of the Canadian dollar relative to the U.S. dollar has experienced wide fluctuations in the last decade, going from roughly parity in 1976, to $0.72 U.S. in 1986, as shown in Figure 2.6. The depreciation of the Canadian dollar was caused primarily by Canada's expanding money supply and higher wage increases relative to the U.S. (see figure 2.7) which ultimately led to Canada's higher costs in producing similar foreign goods and services. Because many of these institutional factors are still in place, the dollar is expected to continue fluctuating in the short term, hovering around the $0.85 U.S. level. Over the longer term, the dollar is forecast to edge slowly towards $0.80 U.S.

Manitoba Hydro reviews its predictions in this area with other experts, and finds them to be generally consistent with the majority.

2.4 Physical Environment

All human endeavor is conditioned by its interaction with the natural environment. It is now acknowledged that not only are human activities influenced by nature, but nature is often influenced by human activity.

Manitoba Hydro is clearly a part of this interaction. By definition, Manitoba Hydro exists to change the natural condition, to convert and transport the energy available in a state of nature to a form and location where it is useful to Manitobans. It cannot do this, however, without regard to the consequences of its actions.

Thus the activities of the Corporation are influenced by the natural resources available, by the environmental conditions surrounding these resources, and by the potential impacts of exploiting them.

This section covers some of the major physical and organizational changes anticipated over the next few years relating to environmental issues, at least insofar as they affect Manitoba Hydro.

2.4.1 Climate Change

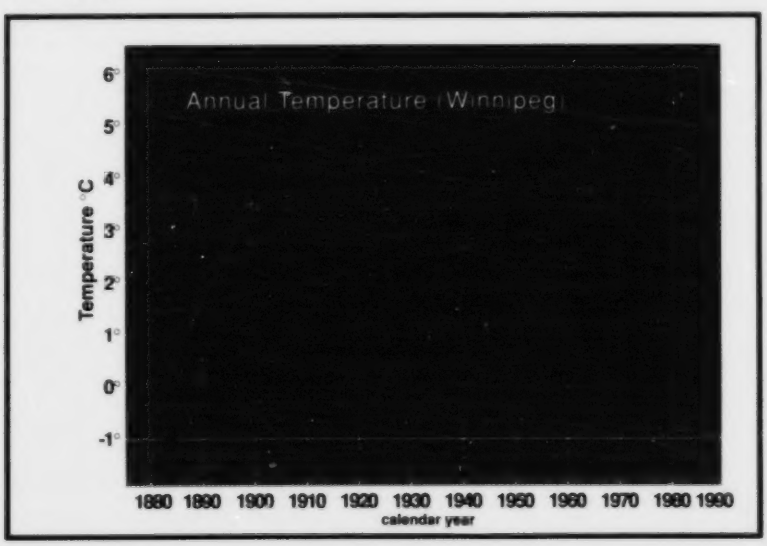
All Manitoba Hydro's activities are related in one way or another to the climate.

Because of recent claims that climate changes are occurring, it is necessary to examine the potential effects of such changes.

Figure 2.8 shows the average annual temperature at Winnipeg since 1880. While a century is not a long period over which to assess climate trends, there does appear to be some evidence of warming.

Precipitation patterns over the Northern Plains and the western Canadian Shield, which are the areas of

figure 2.8 ***Average Annual Temperature at Winnipeg***



prime interest to Manitoba Hydro, have shown wide fluctuations from year to year, but with no apparent trends towards a wetter or drier climate. This is illustrated in Figure 2.9, which shows the annual precipitation in Winnipeg over the last 100 years.

Manitoba Hydro's activities are highly dependent upon climate. The Province's electrical load patterns are shaped by heating and cooling requirements and by the needs of industries such as agriculture and construction where activities may be directly affected by climate. With over 95% of Manitoba Hydro's electrical energy being derived from hydraulic sources, any significant change in the volume and distribution of river flows could have an impact. Even a change in the nature or duration of ice covers on the rivers could be important.

Finally, structures themselves are designed and built with specific meteorologic conditions in mind—snow loads on roofs, flood flows through spillways, wind and ice loads on transmission lines, and so on.

There is a body of opinion in scientific circles that the climate world-wide is becoming warmer, more moist, and less stable, and that at least in part this is due to a build-up of carbon dioxide and other gases in the atmosphere—the so-called 'Greenhouse Effect'. There is also little doubt that the increase in these gases is in large part a result of fossil-fuel consumption in industrialized countries, and also of tropical rain-forest slash-and-burn practices in less developed countries. There is still some doubt as to the rate of climate change, and what, if anything, can and will be done to reduce it. There is even more doubt as to the effects on specific regions.

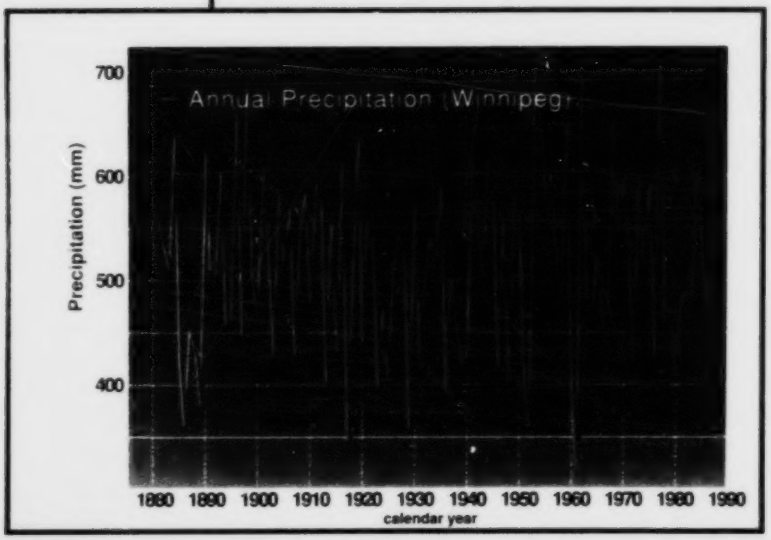
The best information available to Manitoba Hydro is that, while Central North America will continue to be a 'Continental Moist' climate with cold winters and hot summers, over the next 50 to 60 years, there will be noticeable changes.

Average winter temperatures could increase about 1 to 2°C every 10 years, with average summer temperatures increasing at about half this rate. Total annual precipitation will be slightly increased, but the distribution will be such that winters are expected to be wetter, and summers considerably drier. The dry summers will be aggravated by increased evaporation and transpiration. Reliable quantitative assessments of precipitation changes are not available.

Current predictions also indicate increasingly variable weather patterns, with year-to-year conditions varying more from the average. They also indicate an increased frequency and severity of storms.

Because of the uncertainty about the rate and extent of climate change, Manitoba Hydro continues to work with experts in the field in an attempt to predict possible impacts upon the Corporation.

figure 2.9 ***Annual Precipitation at Winnipeg***



2.4.2 Environmental Impacts

Manitoba Hydro's works and operations can cause adverse environmental impacts. Potential and alleged adverse effects on the rights, interests, opportunities, lifestyles and assets of other Manitobans will continue to be closely examined by Manitoba Hydro and by public agencies and the general public. There are con-

cerns about substances such as methyl mercury, PCBs, nitrogen oxides, sulphur oxides and particulate emissions. There are issues such as electric and magnetic fields (EMF); land use conflicts associated with transmission lines; and activities affecting the natural water regime of northern waterways.

Manitoba Hydro is developing more demanding environmental studies and management standards to correct, prevent and minimize the adverse effects of corporate action. Activities will be expanded to prevent harmful emissions and impacts on the environment. When emissions and impacts are unavoidable, the aim will be to reduce them to acceptable levels. Measures will include:

(a) making thorough environmental impact studies for guidance in siting decisions; taking action to prevent or minimize adverse effects;

(b) ensuring effective public participation in the planning of developments;

(c) developing knowledge about the possible health effects, if any, associated with EMF; providing objective information on EMF in public participation programs for transmission line planning; and responding to customer queries on EMF;

(d) providing mitigation and compensation for any adverse socio-economic effects arising from northern reservoirs;

(e) removing PCBs from operating equipment in accessible locations; providing safe containment of PCB contaminated material;

(f) restricting nitrogen oxide, sulphur oxide and particulate emissions from thermal plants;

(g) developing mitigation and compensation programs for people affected by water power developments or transmission lines.

The adverse effects of water power development are expected to be less than the environmental impacts associated with competing sources of energy supply, such as fossil fuels and nuclear fission.

2.4.3 Environmental Regulations

Manitoba's Environment Act was proclaimed in April 1988. This legislation establishes certain requirements which Manitoba Hydro must observe when planning future developments that will cause, or are likely to cause, significant impacts on the environment. As part of the early planning process for future developments, Manitoba Hydro will collect environmental evidence and disclose the nature and extent of environmental impacts associated with such developments. This evidence is the foundation for developing the terms and conditions of licences issued by the Province under the Environment Act, which will ensure that appropriate prevention and mitigation measures are taken to protect the environment and the public interest.

Over the longer term, the concept of sustainable development is expected to be embodied in public policy. Sustainable development implies that energy developments will not foreclose the options of future generations to enjoy the use of natural resources. Sustainable development is not necessarily an obstacle to the development of Manitoba's undeveloped water power sites. In fact, since Hydro's system is based on a renewable energy resource, and sustainable development promotes the use of renewable energy resources rather than fossil fuels, hydro development is generally consistent with sustainable development.

However, it is expected that the planning and operation of future water power developments will be performed in a manner that facilitates the multiple use of waterways for recreational, commercial and other compatible purposes.

Manitoba Hydro's principal obligation is to serve the people of Manitoba, and to assure that service into the future.

In this context, "service" has two meanings. The first is the supply of electric power—when, where and as needed, safely and reliably, efficiently and economically. The second is the personal contact with customers—convenient, courteous, helpful and consistent.

Anticipating future service needs, in both senses of the word "service", is essential to enable the Corporation to continue to meet its obligations.

3.1 Manitoba Customers

Manitoba Hydro's customers are all the people and businesses in the province, with the exception of the central part of Winnipeg which is served by Winnipeg Hydro.

For Customer Service purposes, Manitoba Hydro divides the province into three Regions, as shown in Figure 3.1. These Regions are divided into a total of 28 Operating Centres, and each Centre is then further divided into as many as four districts.

Expectations for future supply requirements are not uniform across the province, as the demographic makeup changes. Expectations for future customer service levels, though, are uniformly high.

figure 3.1 ***Customer Service Regions***

3.1.1 Number of Customers

Manitoba Hydro serves 368 000 customers. The majority of these are residential customers, with significant numbers of farm customers, as well as commercial and industrial (or General Service) customers. In addition there are small numbers of special customers such as seasonal or street lighting customers.

Figure 3.2 shows the number of customers in each of the three major groups in 1978 and 1988, and the number predicted for the year 2000.

The number of residential customers is expected to keep growing beyond the turn of the century, reflecting the slowly increasing population and the decreasing number of people per household. During the same period, the number of farm customers is expected to decline due to urban migration and farm consolidation. Finally, one out of eight customers, historically, has been a commercial or industrial operation and this ratio is expected to continue in the future.

By the year 2000, the total number of customers is expected to be 438 000.

Figure 3.3 shows the distribution of these customers by Region.

Somewhat reflecting the demographic trend away from a rural society to a predominantly urban based society, the number of customers in the Central Region, which includes the Greater Winnipeg area, is expected to grow quite rapidly, while the Eastern and Western Regions are expected to grow more slowly.

3.1.2 Electricity Service and Customer Service

The Corporation both delivers a product (electric-

ity) and provides services associated with the use of that product.

As in any consumer product, the key attributes of electricity are its availability, reliability and quality.

Availability and reliability are measured by the frequency and duration of outages. The Corporation has consistently exceeded the average performance of other Canadian electric utilities during the past 10 years, and plans to maintain this favorable record.

In order to achieve this, Manitoba Hydro will continue a number of initiatives intended to maintain or improve reliability of service. These include the extension of the rural underground distribution system in areas prone to outages due to ice storms; the continuation of maintenance programs on the generation, transmission and distribution systems; and the quick organization and deployment of staff during outages and other emergency situations.

The quality of power is primarily related to voltage levels and frequency ranges, and the prevention of power surges. Quality control is extremely important, because many appliances will not function or could be damaged if the characteristics of the power supply exceed specified limits. In large part, power quality is assured by automatic controlling equipment, but operating employees continuously monitor the system so that they can initiate various precautionary measures if and when necessary.

Manitoba Hydro anticipates no problem in maintaining power quality at levels adequate for the vast majority of customers.

As the utilization of computer and micro-processor controlled equipment becomes more prevalent, certain customers may develop a requirement to provide more protection against transient conditions (spikes, surges, etc.) than can currently be assured. Since the most practical location to provide this sort of protection is right in the equipment, Manitoba Hydro will encourage customers to provide it as needed. The Corporation will offer advice and technical assistance.

Service Excellence

The hour-by-hour supply of electricity is essentially an impersonal process. Customer service on the other hand is a wholly personal matter and relates to a wide range of Manitoba Hydro contacts with individual customers about their use of electrical power. These transactions include customer accounting and billing activities, service extensions, emergency or trouble calls, and information regarding the safe and efficient use of electricity.

For most customers, the only business contact they have with the Corporation occurs when they pay their bills. The Corporation tries to make this as convenient as possible.

The majority of electric meters are read every second month and electricity consumption is estimated in the other months. Most meters are read by Manitoba Hydro, although approximately 80 000 customers read their own and then phone in the results.

Some consideration is being given to remote reading of meters—an attachment to the meter would send in the reading upon request—but it does not appear that this will be viable for several years.

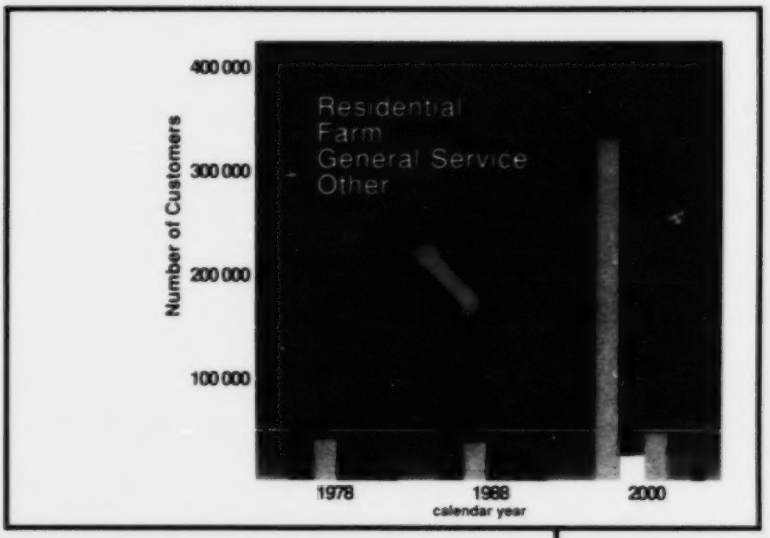


figure 3.2 ***Number of Customers***

For monthly payments, a number of options are currently offered:

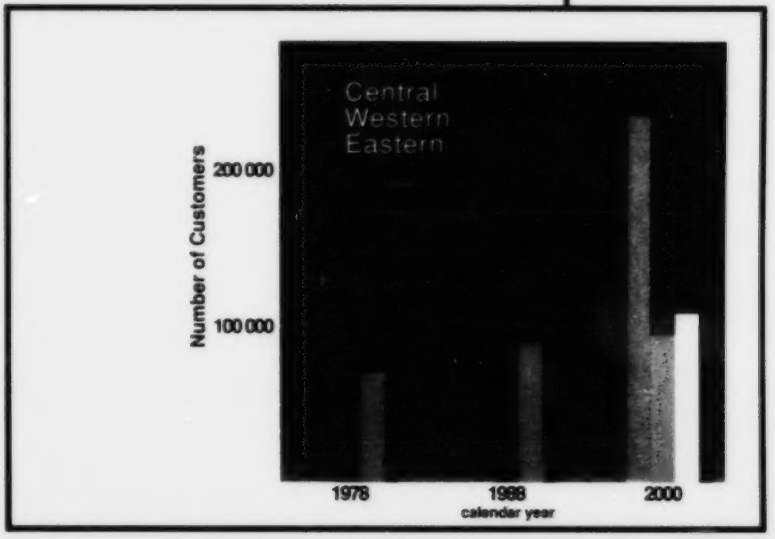
–the Equal Payment Plan allows customers to avoid high bills over the winter through equal, year-round installments;

–a bi-monthly payment option is available to low-volume customers;

–large industrial customers can use electronic funds transfer for payment.

Manitoba Hydro provides several locations for bill payment, all in the interest of convenience. These include all Manitoba Hydro offices, authorized agents,

figure 3.3 ***Distribution of Customers by Region***



drop box systems at other utilities, and payments through the mail.

Manitoba Hydro will continue to provide as high a degree of service as is possible. Options that are being looked into for the near future include electronic funds transfer for all customers, and pre-authorized payments.

Customer Service System

The computer-based Customer Service System was recently introduced to Manitoba Hydro offices throughout the province to provide complete, up-to-date information on customer energy consumption and accounts. The system enables personnel in local Hydro offices to check customer accounts and answer all related concerns almost instantaneously. This allows each District Office to provide full service on a local basis and be a one-stop Manitoba Hydro office in meeting customer needs.

Continual improvements will be made to this system as additional needs are identified.

Service Extensions

Customer service extends beyond metering and payment: connections, disconnections, service additions and extensions must be provided promptly and in a businesslike manner.

The District and Business staff provide quotes on extending service as quickly as possible, while ensuring consistent application of policies throughout the province. Promised in-service dates are considered to be firm commitments.

Emergency and Trouble Calls

Once a customer is connected to the distribution system, it is Manitoba Hydro's commitment to provide that customer with electricity with as few interruptions as possible. Therefore, wherever emergency or problem situations occur, a quick response is the priority.

Advisory Services

Specialized advice on the utilization of electricity is provided by staff, through literature and the media. Information is made readily available to the public, and people are encouraged to contact Manitoba Hydro with any questions or concerns.

To inform consumers about the efficient use of electricity, Manitoba Hydro provides free energy audits of homes through the Home Chec Up Program. This is done on behalf of the Department of Energy and Mines.

French Language Services

In several well-defined areas of the Province, a significant number of customers use French as their language of choice. Manitoba Hydro is implementing a program which will permit these customers to deal with the Corporation in French. French-speaking staff will be located in these areas. Informational brochures and other corporate documents will be made available in French and late 1989, customer bills started to be printed in both English and French.

All Manitoba Hydro employees are trained to appreciate the importance of customer service. Employees will continue to be encouraged to provide quality service—with the expected result that the Corporation's long history of customer satisfaction will be continued and improved.

3.1.3 Evaluation of Service Quality

Service levels, in terms of reliability and quality of power provided, are relatively easy to measure objectively. On the other hand, it is more difficult to measure objectively the quality of personal service. The approach adopted to date has been to conduct periodic surveys.

In 1983, a private consulting firm undertook a corporate image study, and in 1988 Manitoba Hydro performed its most recent energy utilization survey. Both of these surveys included a series of questions on the quality of service provided by Manitoba Hydro.

The results of these studies indicated that the majority of customers (96% to 98%) are satisfied; but, as might be expected, a few problem areas were identified, such as estimated billings. Manitoba Hydro will undertake other such studies from time to time.

In addition to these province-wide studies, several point-of-contact surveys will be implemented to determine customer satisfaction where Manitoba Hydro staff and customers meet on such matters as bill inquiries, tree trimming, ongoing service requests, and information for advice on how to use electric power safely and efficiently. The 1989 point-of-contact survey focuses only on the subject of billing.

An assessment of the quality of customer service is available through information received at the Public Accountability Meetings held at various locations throughout the province.

3.2 Customers' Energy Options

Electricity competes with natural gas, fuel oil, propane and wood to meet customer energy needs. The competitive position of electricity differs, depending upon whether the customer is residential, commercial, or industrial. It also differs by geographic area.

The competition is confined to a limited number of end-uses such as space and water heating, cooking, drying, and industrial process heat. Competition is based upon availability, price, product quality and reliability, and customer service.

3.2.1 Natural Gas and Propane

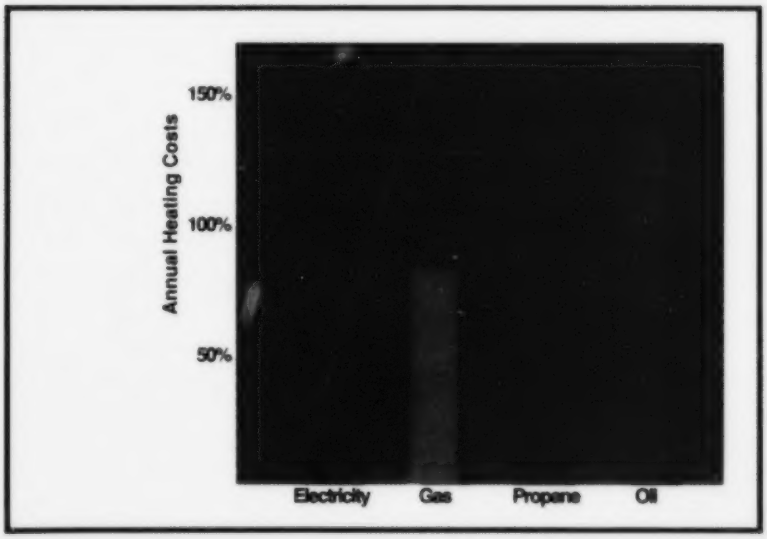
Natural gas is expected to continue in good supply, and remain relatively inexpensive. It is not universally available in Manitoba, being limited to the major cities and towns located within approximately 30 kilometers on either side of the main inter-provincial pipeline. This coverage includes, however, approximately 75% of the population of the province. Extension of natural gas pipelines to additional towns is not anticipated.

Liquid propane gas (LPG) is readily available throughout the province.

Aggressive marketing programs are expected to be mounted by the natural gas and propane distributors, particularly for space and water heating, and for selected appliances such as clothes dryers.

Manitoba Hydro anticipates that where they have the option, the majority of customers for new systems will choose natural gas for space and water heating purposes. This is because space and water heating consume the largest amounts of energy for the majority of customers, and natural gas is the cheapest means of supplying that energy.

figure 3.4 ***Total Energy Service Costs***



It must be recognized that energy prices are only one component of final energy service costs to a customer. The other components include the initial cost of the appliance, such as a heating system, and its annual repair and maintenance costs. Figure 3.4 compares the annual capital and energy cost in 1988 for various energy sources in a 1 000-square-foot bungalow located in southern Manitoba.

The net result is that natural gas is 10% to 15% less expensive than electricity, and is expected to remain that way.

These figures compare the costs of new systems. If a customer already has an electrical system in good working order, then it is not generally economical to switch.

This is demonstrated in Figures 3.5, 3.6 and 3.7. Figure 3.5 shows that, over the past 15 years, natural gas has maintained a relatively steady percentage of the total residential space heating market. On the other hand, the positions of electricity and oil have reversed. Other space heating fuels, primarily wood and propane, have maintained a fairly steady 3% to 4% market share.

Figures 3.6 and 3.7 break these figures down into areas where natural gas is available, and areas where it isn't. It can be seen that there has been negligible conversion from electricity to gas. However, electricity's market share has increased, even in the areas with gas available, essentially because of its convenience for use in apartment buildings.

Figures 3.8 and 3.9 show the stated intent of new home builders for heating systems. They show that natural gas's share of the residential market is expected to remain very high where it is available, but that electricity will continue to win a large share in these areas. Electricity is by far the majority choice for residences in the non-gas areas.

For the reasons of convenience and the cost of switching, Manitoba Hydro expects natural gas to achieve only marginal penetration into the domestic appliance field. Electricity will continue to be the fuel of choice in this area. Natural gas penetration into the new commercial appliance field is expected to be somewhat higher, but again the cost of switching will be too high for the majority of existing customers.

3.2.2 Fuel and Heating Oils

Oil-based fuels can no longer compete with electricity or gas in stationary applications, and their position is expected to deteriorate further with time.

Figure 3.5 showed the decline in the fuel oil share of residential space heating in the province, and the corresponding increase in electricity's share. Figures 3.8 and 3.9 show that very few new residences will be heated by oil.

Conversions from oil to electric heat rose as a result of the 1973 and 1979 oil price increases, and accelerated after the introduction of the Canadian Oil Substitution Program (COSP) which ran from May 1981 to March 1985. The program provided financial incentives to reduce oil consumption. This oil-to-electricity conversion process is essentially complete. It is estimated that there are now only about 19 000 residences in Manitoba that are heated by oil, and that in many of these cases, the investment required to convert to electricity or gas is not warranted.

It is expected that oil will continue to be the fuel of choice for transportation, although the use of LPG-fuelled vehicles is expected to increase, and by the end of the century there probably will be minor trends towards natural-gas-powered and electric-powered vehicles.

3.2.3 Wood and Other Biomass

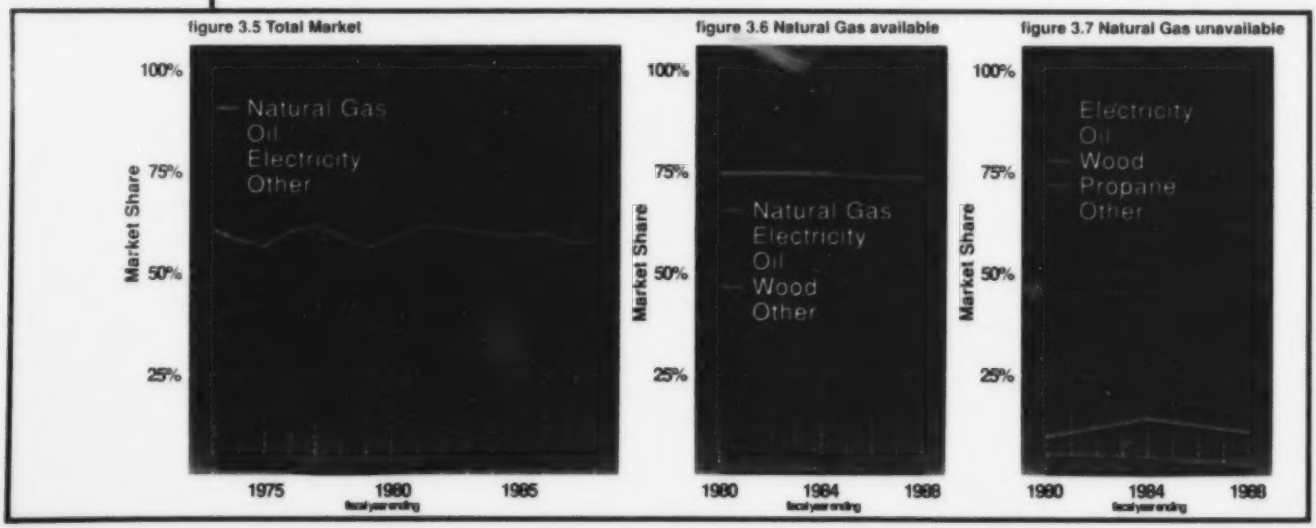
Wood is a viable and renewable resource to the small but significant number of customers in rural areas who have ready access to wood lots. In these cases, the most practical means of exploiting it is to install dual-heating systems which use both electricity and wood. These are almost exclusively restricted to residential or very small commercial applications.

Biomass energy sources such as peat and ethanol are not significant factors and are not expected to become so.

3.2.4 Conservation

Conservation is not really a source of energy, but it can often be regarded as an option for meeting customer needs through freeing-up energy that would

figure 3.5,3.6, 3.7 ***Residential Space Heating***



have otherwise been consumed elsewhere. (Conservation options are discussed elsewhere in this book.) In principle, Manitoba Hydro encourages all customers to conserve all forms of energy where it is practical and economical to do so.

3.2.5 Non-Utility Generation

Customer-generation occurs when customers generate part of their own electricity requirements. Cogeneration is a form of customer-generation where customers use waste heat from another process (e.g. steam used in a pulp mill) to generate electricity.

Independent power producers (IPP) is the term used to cover those customers who are able to generate more than their own requirements and sell the excess to a utility. IPP may use cogeneration facilities or single purpose power generation equipment.

Manitoba Hydro encourages any customer to use waste products for electricity generation wherever it is economical and environmentally sound to do so.

Currently, two of Manitoba Hydro's industrial customers use waste products from their primary production process to produce some of their own electricity. In addition there are a number of rural customers experimenting with windmills.

Manitoba Hydro's relatively low energy prices, coupled with the high capital and operating costs of small scale generating equipment, make it uneconomical for the overwhelming majority of customers to generate their own power.

Manitoba Hydro does encourage the installation of standby, or emergency equipment, by all customers to whom an uninterrupted supply is essential; but it is acknowledged that it will generally be uneconomical to operate these under normal conditions.

Independent power production as a potential source of energy supply to Manitoba Hydro is discussed elsewhere.

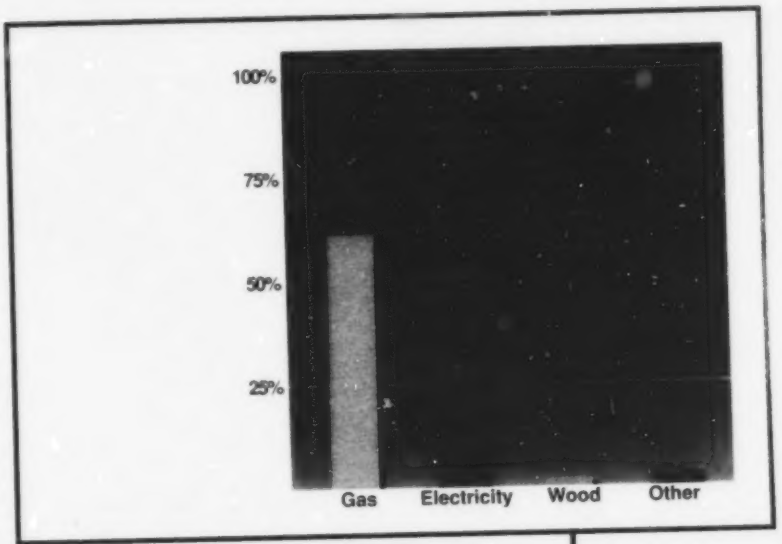
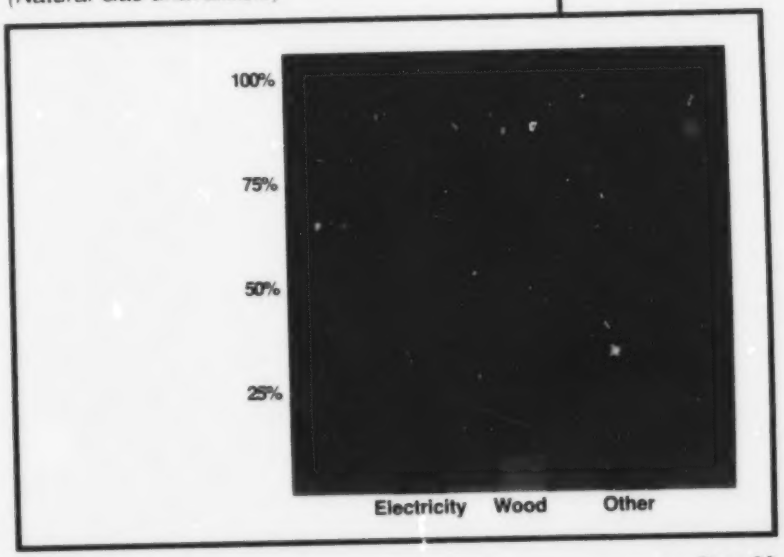


figure 3.8 ***Choice of Fuel for New Homes***
(Natural Gas available)

figure 3.9 ***Choice of Fuel for New Homes***
(Natural Gas unavailable)



3.3 Domestic Power Consumption

Electrical energy consumption in Manitoba, known as the domestic load, has grown steadily since the turn of the 20th century, and is expected to continue to grow into the 21st. Predictions of future consumption are among the most important estimates Manitoba Hydro must make, since these become the basis for all planning and operational activities.

This section reviews the magnitude and characteristics of load growth in the recent past, and summarizes expectations for the next 20 years.

3.3.1 Historic Consumption

In many respects, 1973 was a turning point in the energy industry, being the year in which the OPEC cartel first imposed oil supply restrictions in order to manipulate prices.

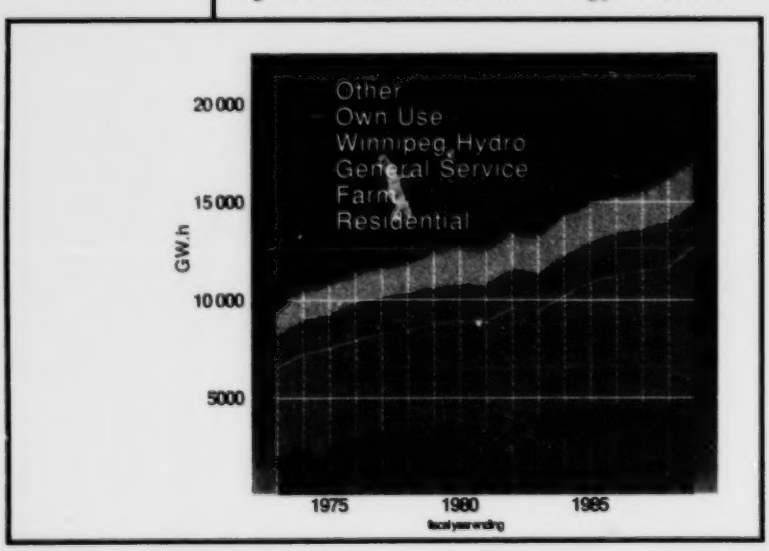
This has been followed by continuing re-evaluation and revision of energy policies throughout North America, most notably directed at reducing the energy requirement to achieve a given end (conservation), and at reducing the market share of oil-based fuels (conversion).

Since 1973, Manitoba Hydro has seen the number of its customers grow; it has encouraged and seen most of these customers implement some conservation measures, and seen many of them convert oil-fuelled processes to electricity.

The net result is that electrical energy consumption in Manitoba has increased by 71% over the last 15 years. This is equivalent to a compound annual increase of about 3.6%.

Significant growth occurred in both the General Service and the Residential sectors. This is illustrated in Figure 3.10. In the General Service sector, which includes all industrial, commercial, and institutional customers, growth was rooted in an expanding economy with an increasing demand for goods and services. The Residential sector growth was based on an expansion in the housing market, increasing appliance usage and a conversion from oil to electricity for space heating purposes, primarily in rural areas where natural gas is not available.

figure 3.10 ***Manitoba Firm Energy - Historic***



3.3.2 Future Power Consumption

Manitoba electrical consumption is expected to grow to about 22.7 billion kilowatt hours per year by the year 2000. This is an increase of 33% over the current consumption of 17.1 billion and works out to an annual compound rate of increase of 2.6%.

As with any prediction, Manitoba Hydro's Load Forecast is founded upon assumptions, and changes in these assumptions would result in a different forecast. In this case, the critical assumptions relate to economic growth, relative energy prices, numbers of households, attitudes and initiatives towards conservation, and so on, all of which are discussed elsewhere.

Every year, Manitoba Hydro prepares a detailed

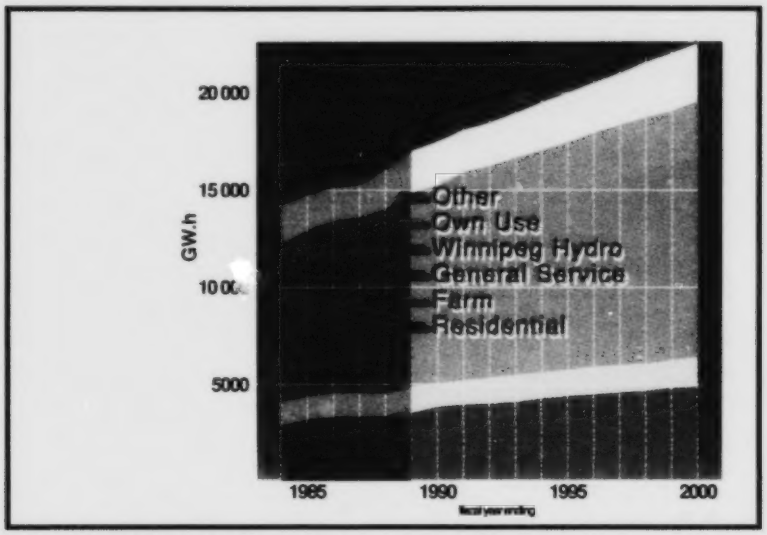


figure 3.11 ***Manitoba Firm Energy - Forecast***

20-year forecast of both energy and peak demand and specifies the assumptions upon which it is based. The current forecast is known as the 1989 System Load Forecast, the energy component of which is summarized in Figure 3.11.

It can be seen that the greatest proportion of total load growth is expected to come from the General Service sector. This is primarily due to continued increasing demand for goods and services, and is partly due to increasing consumption by both new and existing industries using energy-intensive electrotechnologies in their production processes. The forecast rate of growth is moderated by the expectation that industry overall will become less energy intensive as conservation measures continue to be incorporated into plant design and operations.

Figure 3.11 also shows that consumption in the Residential sector is expected to increase, but at a lower rate than in recent years. This is because very few conversions remain to be made from oil to electric heat, and because a significant degree of energy conservation will be achieved through improved building insulation and weather-proofing.

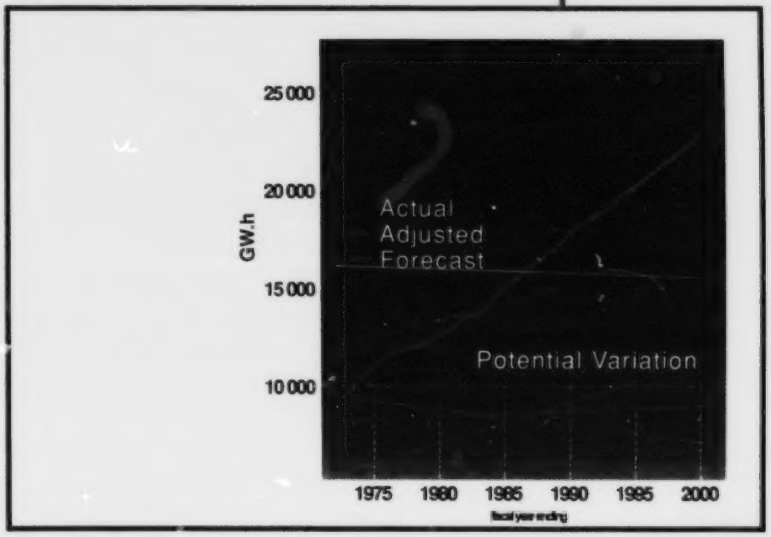
The Farm sector is expected to show slow steady growth, the net result of fewer and larger farms, with increased mechanization on these farms.

Winnipeg Hydro is predicting similar growth in its service area, primarily the result of increasing density in the residential and commercial areas.

Manitoba Hydro's own consumption, which includes the energy used in construction and delivering power through the transmission and distribution system (and sometimes known as system losses) is expected to slowly increase, more or less in proportion to the total energy delivered.

Electricity consumption within Manitoba is becoming more and more weather sensitive, due to the increasing proportion of space heating and cooling loads. Currently, annual energy consumption can vary by as much as plus or minus 5% due to extreme weather conditions. This percentage variation is assumed to remain about the same until the year 2000, but it may increase to about plus or minus 7% as the penetration of electric heat and air conditioning increases. Figure 3.12 illustrates historical energy consumption on an actual and weather-adjusted basis. ('Weather-adjusted' means the energy that would have been consumed had average temperatures prevailed throughout the year.) The base forecast of future energy consumption in Manitoba and the potential variation in consumption due to extreme weather conditions are also shown.

figure 3.12 ***Manitoba Firm Energy - Effect of Weather Variations***



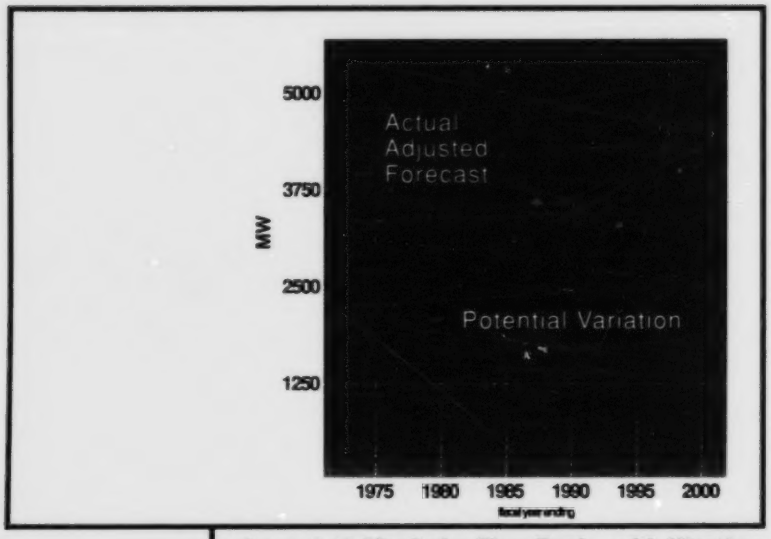
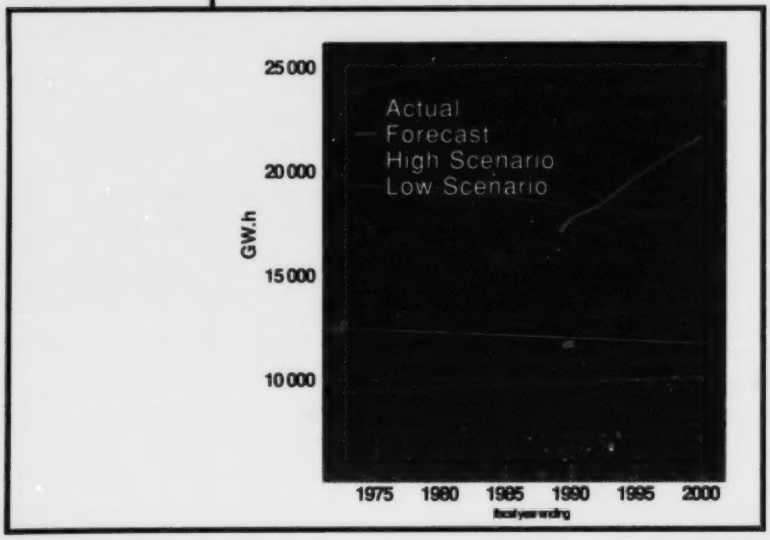


figure 3.13 ***Manitoba Firm Peak - with Weather Variation***

figure 3.14 ***Manitoba Firm Energy - High and Low Scenarios***



The second component of the load forecast is peak demand. Peak demand is the maximum demand upon the system, which usually occurs on a cold, windy weekday evening in early January, but can also occur in late December or early February.

Peak loads have also become more weather sensitive due to the increasing market share of electric heat. The system peak can currently vary plus or minus 6% from expected, due to weather conditions and a combination of other factors that influence peak demand such as time of day, day of week, month, cloud cover and wind. Figure 3.13 illustrates historical peak demand on an actual and weather-adjusted basis. The base forecast of future peak demand in Manitoba and the potential variation due to extreme weather conditions are also shown.

Weather conditions are not the only contributor to uncertainty in the load forecast. As noted earlier, the forecast is based on assumptions about future economic and demographic conditions in the province.

Recognizing that actual events will vary from these assumptions, alternative scenarios are developed and a high and low forecast prepared. Each of the scenarios developed represents plausible outlooks for the future. Figure 3.14 shows that the effect of changing assumptions would be to increase or decrease the base forecast about 15% by the tenth year into the forecast. The low scenario corresponds roughly to a prolonged recession in North America, while the high scenario calls for continued economic growth rates comparable to those experienced in the period 1984 to 1989. The base case, which is felt to be the most probable value, is the case used for planning purposes within the Corporation.

Another source of uncertainty is the fact that individual large industrial loads each represent a major component of the Manitoba load. For example mining loads in Northern Manitoba account for about 15% of sales. If this sector were to encounter resource depletion, economic, financial or other conditions, such as low base metal prices, that caused them to substantially curtail operations, then Manitoba Hydro's domestic load would decrease, at least temporarily. On the other hand, interest is shown from time to time by potential industrial users of large quantities of power. Loads of this nature are specifically excluded from either the base or the high scenario forecasts.

3.4 Marketing Strategies and Programs

It is felt that Manitoba Hydro's future electricity sales can be influenced by the nature of its marketing and advertising programs, whether the programs are active or passive and whether they promote conservation or consumption. The load forecast described in the previous section takes into account current marketing plans.

3.4.1 Historic Strategies

The idea of promoting the use of electricity is as old as the electrical industry itself. Turn-of-the-century utility pioneers were private entrepreneurs, anxious to start earning profits as quickly as possible. They advertised.

With the advent of municipally-owned utilities, the marketing strategies didn't change. The high capital costs had to be recovered. Potential customers were lured by newspaper ads extolling the advantages of electric light and electric appliances. Utility showrooms became common—places where folks could actually see appliances in action—and where persuasive salesmen could close a deal.

In Manitoba, it was the establishment of the provincially-owned Manitoba Power Commission in 1919 that signalled a new era in marketing. The MPC's commitment was to bring low-cost central-station power to rural Manitoba. To accomplish this task, it was necessary to canvass whole communities, selling the promises of the Electrical Age. The motive was no longer profit. The motive was the altruistic goal of improving the quality of life for all Manitobans—and at least break even in the process.

Rural electrification progress was slow but steady through the depressed 30s and the early 40s. And yet, amazing as it sounds today, in the year 1945, at the end of World War II, little more than 500 Manitoba farms out of some 59 000 in the province had electric power.

It was an all-out marketing blitz in the late 1940's that brought Manitoba farms into the 20th century. The aggressive campaign focused on community self-help—with wiring schools for installers, courses for women explaining the uses of electricity, appliance sales with the assurance of at-cost repair service.

The formation in 1949 of a second provincial utility, The Manitoba Hydro-Electric Board, introduced yet another marketing motive. The Board's mandate was to develop the province's hydro resources in the most efficient way—while simultaneously supplying customers at the lowest long term rates. This meant that active load-building was absolutely essential if low rates were to be maintained in a period of unprecedented capital outlays. The theme was "Live Better Electrically."

The advent of piped natural gas in 1957, and the availability of large amounts of energy from northern generating stations starting in the early 60s, resulted in a major sales thrust, particularly in the water heating and space heating markets. This came to an abrupt halt in the early 1970s with the oil crisis, inflation and rising energy prices—culminating with the current strategy of promoting the "wise and efficient" use of all forms of energy.

3.4.2 Current Strategies and Objectives

Manitoba Hydro's current marketing objectives can be classified into five main groups:

a) service excellence
b) promotion of conservation and selected sales
c) promotion of electrotechnologies
d) revenue protection
e) balancing supply and demand

Service Excellence

Staff attitudes and actions that are perceived as being customer responsive are fundamental to all marketing activities, and are emphasized throughout the Corporation.

Systematic monitoring of customer needs through surveys and other techniques will identify new market requirements in their initial stages and will also permit evaluation of the level of customer satisfaction.

Promotion of Conservation and Selected Sales

General conservation of energy is promoted, particularly in the area of space heating. However, some additional loads are considered "inevitable"; for example, space heating conversions from oil to electricity where gas is not available. If the capacity to provide service is already in place, then it is beneficial to advance these sales. Similarly, air conditioning is an extra summer load sold at full retail rates, using plant capacity designed to meet higher winter loads.

By combining promotion of increased summer loads in conjunction with conservation efforts overall, the annual utilization will be improved, with a net reduction in average costs—thus contributing to the maintenance of low rates.

Promotion of Electrotechnologies

Industrial electricity effectiveness programs—electrotechnologies—have the potential to promote greater productivity and efficiency in Manitoba industry through the use of electricity. Electrotechnologies are more than the simple substitution of electricity for conventional or fossil fuel processes. Electrotechnologies increase productivity and profitability, improve energy efficiency, save in raw materials, improve product quality, reduce environmental costs and improve working conditions.

Some of the industrial processes under consideration include heating, drying, heat treatment and smelting. Fossil fuels were traditionally used for these processes, but in many cases electricity can now do the job more efficiently and economically.

While many of these technologies are applied widely in Europe, they are not widespread in North America.

Manitoba Hydro is working to build a partnership between the utility, its customers, equipment manufacturers, engineering consultants and government industrial development officers in order to make effective use of these emerging electrotechnologies, and to help

Manitoba industry remain competitive.

Revenue Protection

The Manitoba electric supply plan is based on the assumption of a stable base of sales. To ensure the fiscal viability of the Corporation, this base must be protected through good customer services and product support programs.

Balancing Supply & Demand

The final marketing objective is to shape future demand for electricity so that it more closely balances future supply capabilities. This is known as Demand-Side Management and is more fully described in another section.

3.4.3 Current Marketing Programs

Marketing objectives are being achieved through programs focused on energy management, education, information services, revenue programs and energy utilization. The following is a summary of each of these.

Energy Management Programs (Conservation)

Energy management encourages economy and efficiency in the use of electricity in all sectors.

The current focus is two-fold: a) increasing the resistance to heat loss in various structures, and b) ensuring efficient operation of major energy-consuming equipment and appliances.

The Corporation is actively working with customers, members of allied trades, architects and consultants in order to stimulate the building and retrofitting of structures in all markets to specifications that are superior to existing Federal and Provincial codes.

Increased efforts are being made to influence Manitoba Hydro's customers in energy management.

Education Programs

Education programs are designed to foster the development of efficient energy-use attitudes in the general public. There are also programs aimed specifically at students, encouraging the development of positive attitudes toward using electricity safely and efficiently.

Ongoing programs provide the means for dissemination of information geared to specific target groups. Programs include Agriculture Improvement, Calendar, School Program, Posters, and Welcome Wagon.

Information Services

Assisting customers with their energy management needs and providing advisory services on energy efficiency options is another way in which the Corporation encourages customers to make knowledgeable decisions on the effective use of electrical energy. Print material, audiovisual productions, displays and publications play a major role in providing this service.

There are pamphlets, brochures and data sheets available at Hydro offices and also at display and trade shows with which the Corporation is involved. Additionally, the publication Farm Light & Power reaches 35 000 farm customers monthly; the newsletter Current Comment is mailed to teachers of home economics and industrial arts quarterly; Hydro Lines, Manitoba Hydro's bill insert, reaches every customer regularly; and case studies are produced for architects and consultants on a bi-monthly basis.

Revenue Programs

Revenue programs are two-pronged thrusts that provide information on energy management, safety and security to customers while seeking additional revenue in certain sectors: for example, where conversion or installation is likely within the next ten years in any event, or where more effective use can be made of existing facilities.

Marketing programs falling into this category include the promotion of air conditioning, water heating, supplementary electrical heating, and conversion from both residential and commercial oil heating systems.

Energy Utilization Research Programs

Research programs conducted in cooperation with Manitoba Hydro's customers and industry associates provide accurate information on new and updated equipment and applications, particularly in the agricultural, commercial and industrial areas.

Current research projects include the use of electricity in lieu of coal on Hutterite Colonies, commercial application of heat-pump technologies, the use of microwave technology for rendering of animal products, and many others.

3.5 Demand-Side Management

Any attempt by the supplier of a product or service to influence its customers' use of that product can be called Demand-Side Management (DSM). For example, television commercials are basically DSM programs designed to increase consumption.

In the electrical industry, DSM is more particularly considered to consist of actions by the utility to change the nature of its customers' requirements, usually with the objective of the utility's being able to more economically meet all its customers' needs. It also usually has the connotation of the utility investing, to a degree, in order to modify consumption rather than to merely satisfy consumption.

In a utility setting, DSM can consist of three categories of programs. Firstly, programs can be designed to promote consumption. Typical examples would be the sale of surplus energy, or the recruitment of new industrial customers.

Alternatively, programs can be designed to encourage conservation: for example, promoting building insulation or high efficiency light bulbs.

Finally, programs can be designed not to increase or decrease energy consumption, but to re-shape the load to produce more uniform consumption. Overnight storage heaters and load management centres in large industrial buildings are examples of this.

Depending upon the circumstances of a utility, it may be appropriate to promote any one or all of these at a given time.

For example, in Manitoba Hydro's case, when it has a short term surplus of power, promoting sales through new customers may be economically viable. On the other hand, over the long term, it may be beneficial to reduce all customers' demand for power, promoting energy conservation in order to defer new investments in building new generating stations and transmission and distribution lines.

To a certain extent Manitoba Hydro's current marketing programs are designed to do all of these. However, they tend to be passive in nature, that is, they are designed to inform but they rely on individual customers to initiate action. The current load forecast assumes continuation of these informational programs.

As previously noted, DSM in a utility context implies a more active role by the utility in promoting conservation and in shaping the load, to the extent of providing incentives such as rebates, modified rate structures, loans or grants.

Manitoba Hydro has recently stepped up its efforts to identify practical and economic demand-side options. The overall objective is to determine the mix of demand-side and supply-side options that best meet both the customers' demand for energy and result in the lowest overall cost of power to all customers. It is anticipated that, as a result of this process, the Corporation will adopt selected programs that conserve energy or reduce peak demand at a cost less than the long-term marginal cost of supplying that power. Any DSM programs adopted will be designed to ensure that the energy needs of Manitobans will be met without adversely affecting their quality of life.

However, the nature, size and potential benefits of such programs to Manitoba Hydro are not presently known. Experience in other utilities is of only limited value, because there are few predominantly hydraulic utilities with comparably low energy prices operating in a similar cold climate.

The primary uncertainty about these programs is customer participation and its long-term effect on electricity use and load shapes. A significant amount of market research, including surveys, market testing, pilot programs and so on is required to determine these, and is currently being planned.

It is expected to be several years before the uncertainties will be sufficiently resolved that demand-side options can be fully developed and considered with the same level of confidence as supply-side plans.

For planning purposes, Manitoba Hydro has adopted a target of a 100 MW (equivalent to 500 GW.h/yr) reduction in the load to be served by the year 2001. This reduction, which is to be achieved through a combination of DSM measures and supplies from non-utility generators, is approximately equivalent to one year's load growth.

3.6 Power Service to Remote Communities

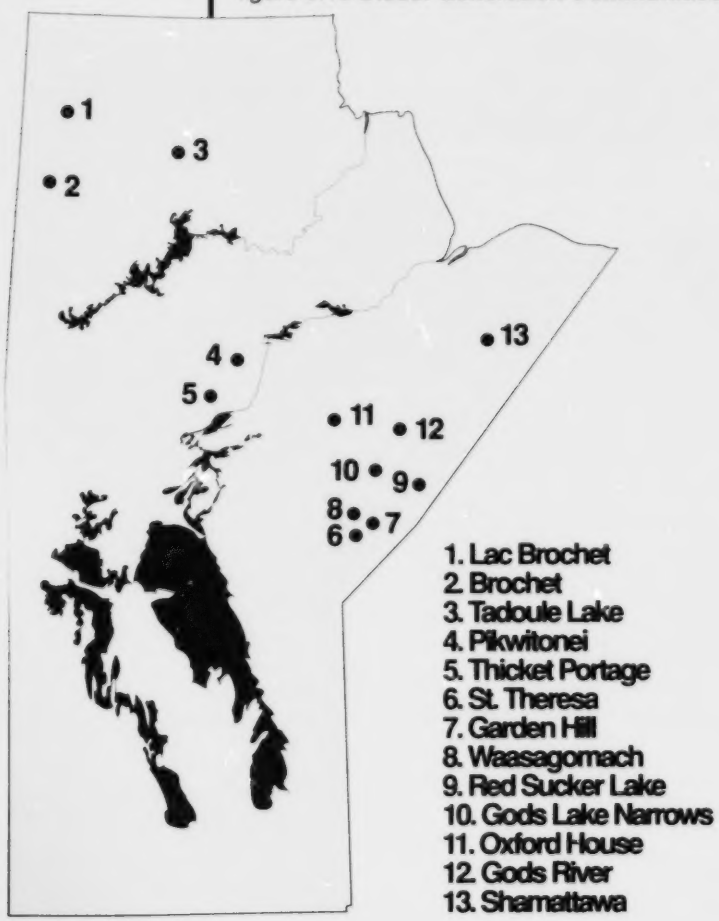
Manitoba Hydro has 13 communities still being serviced by diesel generation:

Brochet	Red Sucker Lake
Garden Hill	Shamattawa
Gods Lake Narrows	St. Theresa Point
Gods River	Tadoule Lake
Lac Brochet	Thicket Portage
Oxford House	Waasagomach
Pikwitonei	

These are shown in Figure 3.15. All are small communities in remote locations in northern Manitoba and are not connected to the central transmission system.

Diesel generators are extremely expensive to operate and maintain. Consequently, special conditions apply to service to customers in these areas.

figure 3.15 ***Diesel Generation Communities***



3.6.1 Supply and Pricing Policy

For the majority of customers in these remote communities, service capacity is limited to 15 amp service. (For comparison, most residences in other parts of the Province enjoy a 100 amp or 200 amp service). The diesel area customers pay normal residential rates, as would equivalent customers on the central system. This rate is substantially less than the cost of generation at these locations.

Diesel area customers (both residential and commercial) requiring service capacities greater than 15 amps are provided such capacity, but must pay rates which cover the full cost of operations. These rates are much higher than those charged customers elsewhere.

It is acknowledged that these policies impose limitations on the social and economic opportunities in the communities; relaxation of the policies, however, would result in further subsidization of these customers by other Manitoba Hydro customers.

3.6.2 Extension of Central System Supply

Since 1968, when it assumed responsibility for serving these remote locations, Manitoba Hydro has constructed transmission lines into over 20 such communities, and is prepared to construct them into all the remaining communities. However, the utility's policy regarding the extension of such lines is that capital contributions are required to cover the cost.

These communities are all administered by one or more of the various Indian Bands, the Federal Department of Indian Affairs and Northern Development, or the Provincial Department of Northern Affairs. In addition, the latter two are usually the main customers, and would benefit most from reduced rates associated with central power.

Consequently, the Corporation works closely with each of these three groups in trying to determine the feasibility of connecting these various diesel communities to the central system.

3.6.3 Current and Planned Activities

Within the past few years, five remote communities on the east side of Lake Winnipeg, as well as the town of Churchill, have been connected to the central system.

Three further connections are currently under consideration.

Firstly, Manitoba Hydro, the Province of Manitoba and the Federal Department of Indian Affairs and Northern Development have tentatively agreed to replace diesel generation with central system supply for the North Central Manitoba Project. This project would serve the communities of Garden Hill, St. Theresa, Gods Lake Narrows, Waasagomach, Gods River, Oxford House and Red Sucker Lake.

The same three parties will also be studying the feasibility of a line to serve the community of Shamattawa. Finally, Manitoba Hydro and the Provincial Department of Northern Affairs have discussed the feasibility of a line to serve the communities of Pikwitonei and Thicket Portage.

Options regarding the remaining three locations are also under review.

3.7 Winnipeg Hydro

Winnipeg Hydro is a special case of a domestic customer. Winnipeg Hydro is a Department of the City of Winnipeg and operates its own generating, transmission and distribution system. Its service area is limited to the area contained within the boundaries of the City of Winnipeg as they were on April 1, 1955, and is completely surrounded by Manitoba Hydro service areas. See Figure 3.16. Winnipeg Hydro's generating plants can supply about 45% of its requirements, and it obtains the balance from Manitoba Hydro under a cost-sharing arrangement.

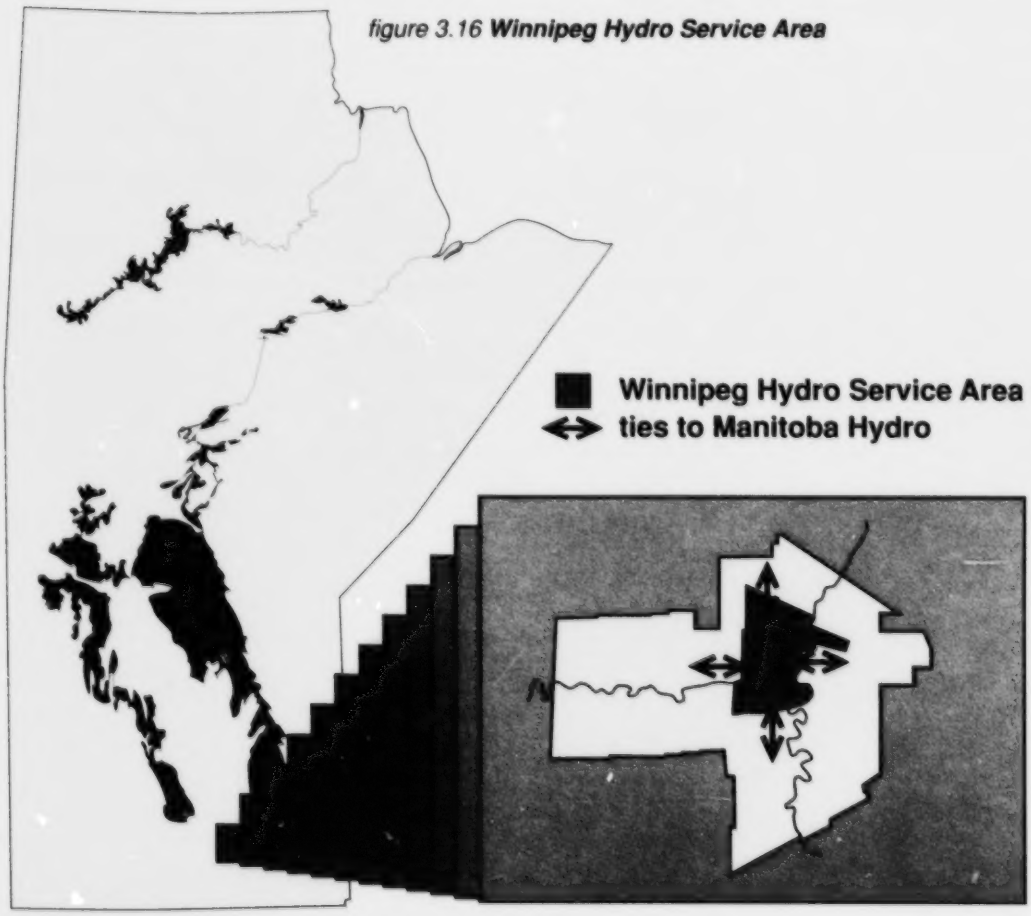
For system planning and operating purposes, the Winnipeg Hydro and Manitoba Hydro generation and transmission systems are considered as a single integrated system.

Also, by legislation, Winnipeg Hydro must charge the same rates as Manitoba Hydro.

Winnipeg Hydro has approximately 90 000 customers, and annual energy sales and a peak load of about 2 500 GW.h and 470 MW respectively.

Manitoba Hydro enjoys a good working relationship with Winnipeg Hydro, and subject only to the ongoing requirement for operating agreements, no major changes are contemplated.

figure 3.16 ***Winnipeg Hydro Service Area***



The majority of North American electrical utilities are interconnected to their neighbors, an arrangement that has proven to be beneficial to everyone involved.

Manitoba Hydro enjoys interconnections with utilities to the east, south and west.

The circumstances of each of these utilities are quite different, resulting in significant opportunities for Manitoba Hydro.

Interconnections help provide a high degree of stability to the Manitoba Hydro system, and help avoid system outages due to mechanical and electrical problems. They also facilitate the import and export of power.

Manitoba Hydro's export operations are all directed at reducing the cost of power to its Manitoba customers, both now and into the future.

4.1 Neighboring Utilities

An understanding of its customers' needs and opportunities is crucial to the success of any business. Since a large part of Manitoba Hydro's business is with neighboring utilities, understanding their situations is important. This section gives a brief description of each of the utilities with which Manitoba Hydro currently trades.

figure 4.1 ***Ontario Hydro***

4.1.1 Ontario Hydro

Ontario Hydro is one of the largest corporations in Canada, and one of the largest power utilities in the world. It sells electric power wholesale to Ontario municipal utilities in urban areas which, in turn, retail to customers in their service areas. Ontario Hydro also directly serves large industrial customers and rural retail customers in areas or communities not served by municipal utilities. In 1987, approximately 3 344 000 customers were served by Ontario Hydro and the municipal utilities in the province. The Ontario Hydro system is in reality two distinct areas interconnected by a relatively weak tie line: their Eastern System is the largest in load requirements and generation availability; their Northwestern System borders on Manitoba.

The total installed capacity in the Ontario Hydro system as at January 1987 was 25 700 MW of which only 1 160 MW was in the Northwestern System.

Ontario Hydro has a mixture of Nuclear, Coal-Fired and Hydraulic plants.

Currently, Manitoba Hydro's import and export opportunities are restricted to the relatively small Northwestern System. The characteristics of this Northwestern System are generally similar to Manitoba Hydro's. The system has a large hydro-electric component, so is subject to flow variations and droughts, generally in common with Manitoba Hydro. It is a winter peaking system, as is Manitoba Hydro's. The major differences are in their large thermal generating component, and the fact that their further hydro-generating options are somewhat limited.

Ontario Hydro's Eastern System is heavily interconnected with several United States utilities as well as Hydro Quebec, as illustrated in Figure 4.1. Ontario Hydro's Northwestern System is interconnected with

Manitoba Hydro through 2 - 230 kV. and 1 - 138 kV. lines. These lines have a total capacity of approximately 375 MW.

Ontario Hydro is currently experiencing rates of load growth higher than expected, and is aggressively investigating various means of meeting future requirements.

Ontario Hydro has recently agreed to purchase 1000 MW from Manitoba Hydro starting in November 2000. This will require the construction of a fourth interconnection between Manitoba and Ontario, and substancial improvement of transmission capacity between Ontario Hydro's Northwestern and Eastern Systems.

4.1.2 SaskPower

SaskPower provides electricity to approximately 405 000 customers in Saskatchewan.

To meet the load requirement of these customers there is a total connected hydraulic capacity of 824 MW, thermal generation of 1 764 MW, and 136 MW in gas turbines for a total available capacity of 2 724 MW.

In addition, the 280 MW coal-fired unit at Shand is scheduled to be go into service in 1992, bringing the total capacity to 3 004 MW.

SaskPower has five interconnections with Manitoba Hydro totalling 340 MW, one with Basin Electric Power Company in North Dakota of 100 MW capacity, and has recently completed one with Alberta Power Ltd. of approximately 150 MW. These are shown in Figure 4.2.

figure 4.2 ***SaskPower***

4.1.3 MAPP

The Mid-Continent Area Power Pool (MAPP) is one of the nine regional reliability councils comprising the North American Electric Reliability Council (NERC). The MAPP region covers all of the states of Iowa, Minnesota, Nebraska, North Dakota, most of South Dakota, and portions of the states of Illinois, Michigan, Montana and Wisconsin. The Provinces of Manitoba and Saskatchewan are included in the MAPP region as well. The region together with the other NERC regional councils is shown in Figure 4.3.

MAPP is not an electrical utility—rather it is an association of electrical utilities. Manitoba Hydro's energy transactions are with individual utilities; however, because of their cooperative nature, it is useful to look at them as a group as well as individual companies.

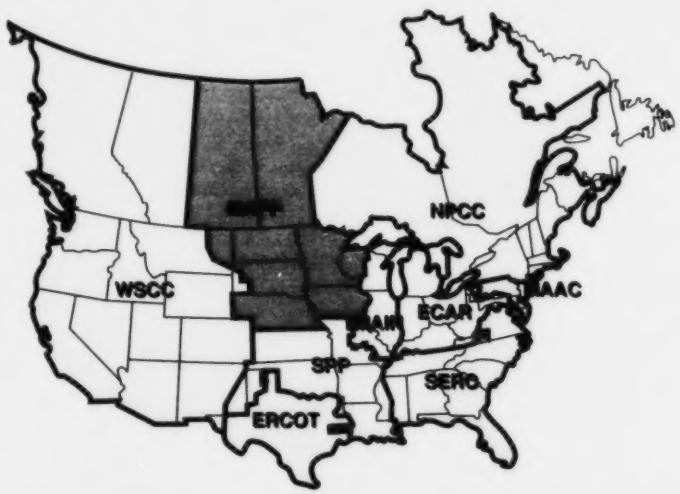
MAPP involves a mixture of investor-owned utilities, generation and transmission cooperatives, public power districts, municipal utilities and a federal agency. It presently has a participant membership of 27 large systems and 12 small systems. Manitoba Hydro is a liaison member and SaskPower an associate participant of MAPP.

MAPP in turn has a series of agreements with the neighboring councils, which provide for a high degree of operating and planning flexibility.

The total energy sales of the U.S. MAPP utilities is about seven times that of Manitoba Hydro.

Most U.S. MAPP utilities are summer-peaking; that is, their load is higher in summer than in winter—the opposite to Manitoba Hydro.

figure 4.3 ***NERC Regional Councils***



The MAPP members with whom Manitoba Hydro has direct transactions are Northern States Power Company, United Power Association, Minnkota Power Cooperative Inc., Otter Tail Power Company, and Minnesota Power.

4.1.4 Northern States Power Company (NSP)

NSP is an investor-owned electric utility company serving customers in Minnesota, Wisconsin, North Dakota, South Dakota, and Michigan. See Figure 4.4. Total sales are about twice Manitoba Hydro's.

Available generation in the NSP system is predominantly thermal (coal and nuclear). NSP both imports energy from Manitoba Hydro and other utilities, and resells that which is surplus to its own needs to yet other utilities.

4.1.5 United Power Association (UPA)

UPA is a generation and transmission cooperative supplying wholesale electricity to 15 member distribution cooperatives serving approximately 216 000 member consumers. Their service area covers 34 counties in Minnesota and three counties in Wisconsin. UPA is headquartered in Elk River, Minnesota. See Figure 4.5. UPA sales are about one seventh of Manitoba Hydro's.

4.1.6 Minnkota Power Cooperative Inc. (MPC)

MPC is a generation and transmission cooperative supplying wholesale power to twelve distribution cooperatives serving more than 74 000 rural consumers. Their service area includes 33 counties in northeastern North Dakota and northwestern Minnesota. Minnkota is headquartered at Grand Forks. See Figure 4.6. MPC sales are about one tenth of Manitoba Hydro's.

4.1.7 Otter Tail Power Company (OTP)

This is an investor-owned electric utility serving approximately 122 000 customers in small towns and adjacent rural areas in eastern North Dakota, western Minnesota and northeastern South Dakota. See Figure 4.7. OTP is a winter-peaking utility, with sales about one sixth of Manitoba Hydro's.

4.1.8 Minnesota Power

Minnesota Power is a diversified investor-owned electric utility which provides power in northeastern and central Minnesota. See Figure 4.8. Non-electric businesses, operated through subsidiary companies, include paper manufacturing and telephone, natural gas, water and waste, and water treatment utilities. The company's head office is located in Duluth, Minnesota, while subsidiary interests are located in Michigan, Florida, the mid-western seaboard, and the southwestern states.

Approximately 117 000 electrical customers are served in Minnesota. Minnesota Power's sales are just under one half of Manitoba Hydro's. Its peak load occurs in winter, but is not significantly higher than its summer load.

Minnesota Power's primary source of supply is through thermal generating stations.

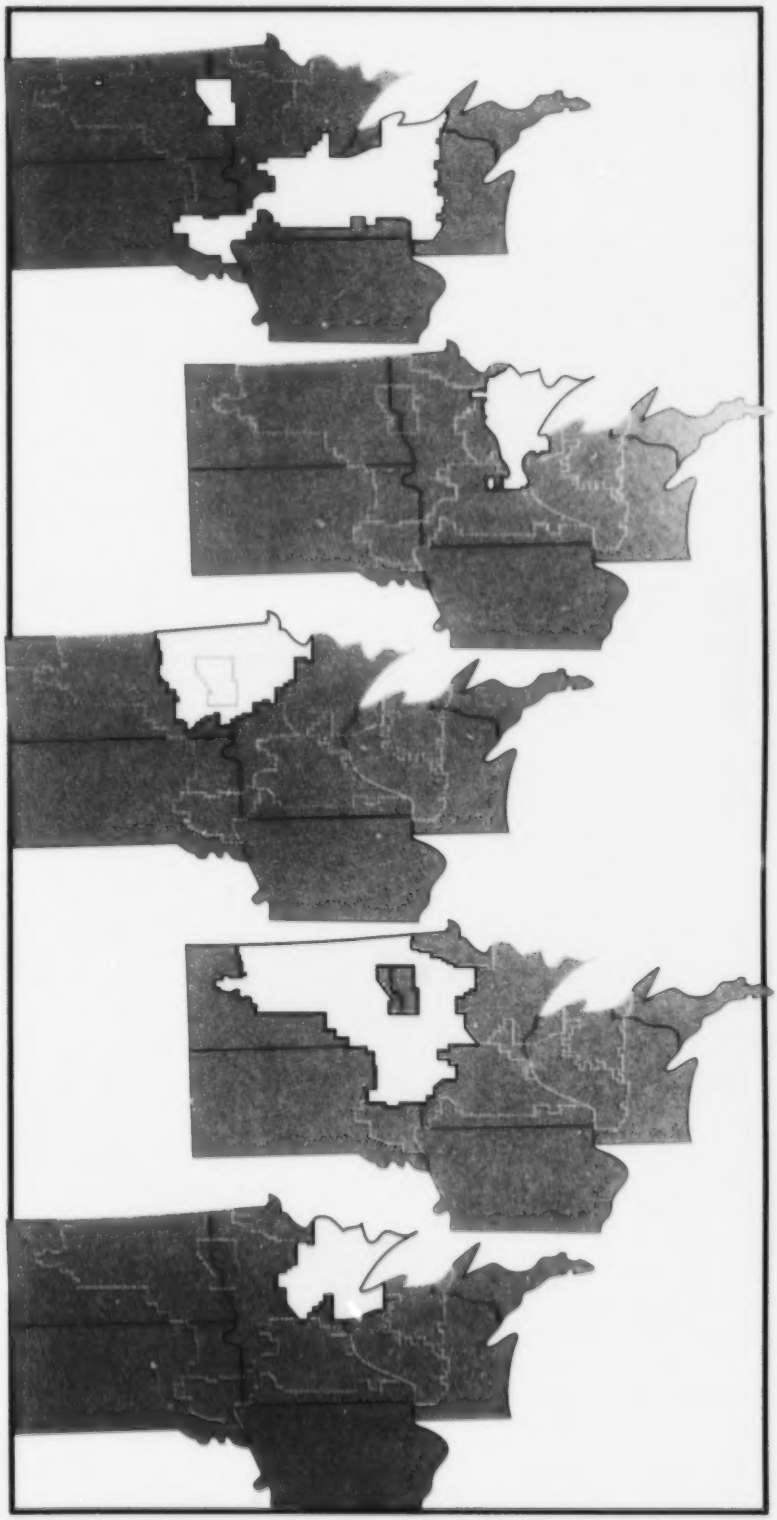
figure 4.4 ***Northern States Power Company***

figure 4.5 ***United Power Association***

figure 4.6 ***Minnkota Power Cooperative Inc.***

figure 4.7 ***Otter Tail Power Company***

figure 4.8 ***Minnesota Power***



4.2 Surplus Energy Sales

Because the majority of Manitoba Hydro's generating plants are hydraulic—that is they rely on river flows to provide the source of energy—there are two factors that result in more energy normally being available than is required to meet the Manitoba need.

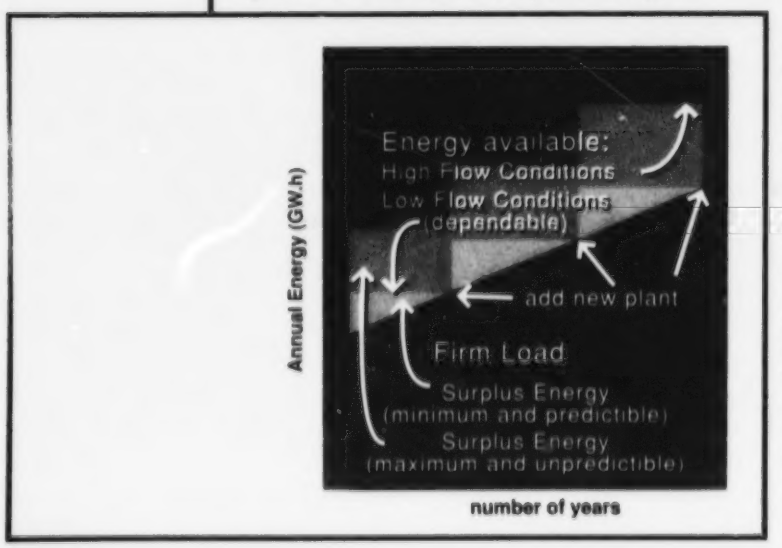
The first is that while consumption increases on a fairly steady basis, hydraulic generating stations come into service in large blocks.

Since much of the cost of building a hydraulic generating station is associated with the main dam and dykes, it is economical to schedule the construction of all the generators in the plant in sequence rather than installing units to follow customer load increases. This creates the situation where there will always be a predictable surplus of power and energy immediately after a new plant is brought into service. This surplus diminishes with time until just before the next plant is commissioned.

The second factor is that the system must be designed to be adequate under low water conditions. Water conditions can vary extensively, with droughts at one extreme, and floods at the other. In most years, there will be more than minimum flows, thus resulting in energy surplus to Manitoba Hydro's requirements. The amount of this type of surplus energy is essentially unpredictable. Figure 4.10 illustrates both the predictable and unpredictable surplus energy inherent in any hydraulic system.

Through its interconnections with neighboring utilities, Manitoba Hydro is able to sell this surplus energy instead of having to spill water over the dams. The revenue received reduces the revenue that would otherwise have to be collected from Manitoba customers.

figure 4.10 ***Sources of Surplus Energy***



4.2.1 Current Conditions

Under low flow conditions, known as "dependable flows", Manitoba Hydro's hydraulic generating stations are capable of generating 16 700 GW.h per year. However, Manitoba consumption was 17 100 GW.h in 1988/89, and is increasing at approximately 500 GW.h/year. So, in a low flow year, the difference would have to be made up from the thermal generating stations and from imports of energy from neighboring utilities.

Under median flow conditions, the hydraulic system is capable of generating 21 200 GW.h/year, and under maximum flow conditions this figure becomes 26 300 GW.h/year. Therefore any flows in excess of minimum provide surplus energy—but this is completely unpredictable more than 3 to 6 months ahead.

This surplus is sold as interruptible energy to the highest bidder among all the utilities with whom Manitoba Hydro has interconnections. Interruptible energy is sold under spot market conditions, and is subject to cancellation at virtually no notice.

Between 1982 and 1987, the hydraulic system was still capable of generating 16 700 GW.h per year

under dependable flow conditions, but the domestic load was less than this. Consequently there was a small, certain surplus each year that could be contracted to be sold on a short-term firm basis. In a case like this, sales are contracted for approximately six-month periods, three years in advance. Since this energy is sold as firm, it commands prices somewhat higher than interruptible.

However, by far the largest volume of the two categories is the interruptible power. This also has the largest variation in volume depending on river flows. The price of this power is governed by many factors, which can vary daily and in some cases hourly, because of breakdowns of generation and unanticipated loads in the buyers' systems. To buy interruptible power the purchasers must have their own generating capacity. Interruptible power therefore displaces higher cost generation on the purchaser's system, and is priced accordingly. The price is dependent upon:

a) The marginal cost of the purchaser's generation; in most cases this is the cost of the fuel that the purchaser would otherwise have to consume.

b) The volume of power sold; power sold displaces the highest cost generation first, then as more power is sold it starts to displace the lower cost generation, and the available price is reduced.

All power, both interruptible and short term firm, is sold at the respective international or provincial boundaries; hence is wholesale. The purchasing utility still has to absorb the cost of transmitting, transforming and distributing the power.

The prices received for both firm and interruptible power compare favorably with that charged Manitoba's large industrial customers. The price received for short term firm power is in excess of that charged industrial users, and the energy rate for interruptible power is in excess of the industrial users' firm energy rate. This is illustrated in Figure 4.11, which compares the average rate received for surplus energy exports with the energy rate charged to large domestic customers.

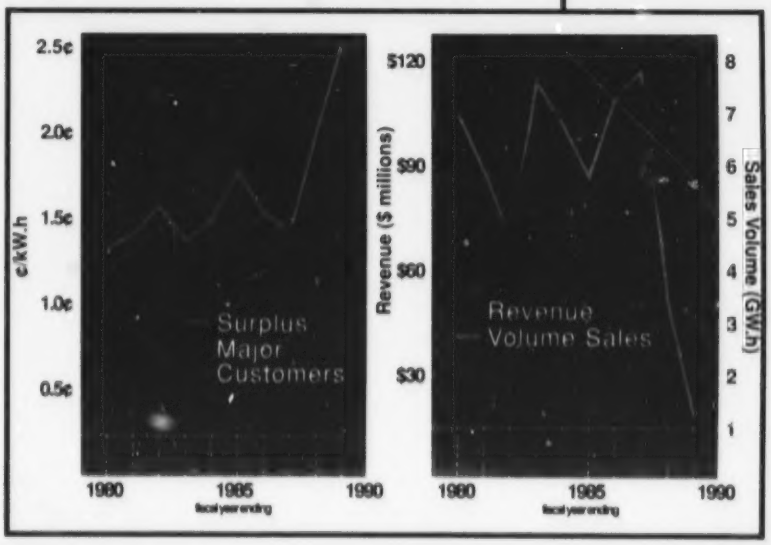
Figure 4.12 shows extra-provincial energy sales volumes and revenue in the period 1980 to 1988. The revenues are partially offset by the incremental cost of producing that power but the net result is an approximately $750 million saving that Manitoba customers would otherwise have had to pay.

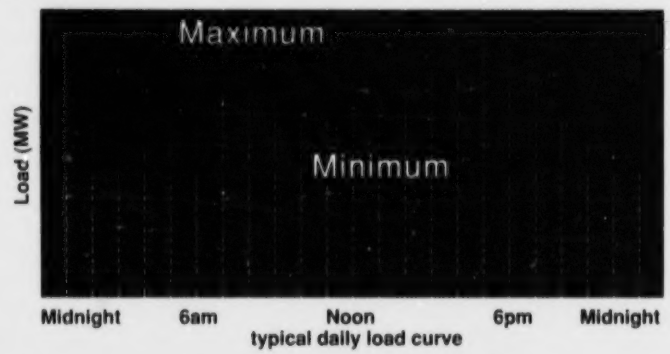
Throughout 1987 and 1988, surplus energy sales were sharply reduced as a result of the drought conditions. River flows were close to the minimum ever recorded.

For much of these two years, Manitoba Hydro has been a net importer of energy, but the differences between Manitoba Hydro's mainly hydraulic system and the neighbors' mainly thermal systems have permitted both Manitoba Hydro and the sellers to make a small profit on the transactions.

Under these circumstances, Manitoba Hydro is able to shut down its generators at night, store water in the reservoirs, and import energy from its neighbors. Night-time energy in a thermal system is relatively cheap. During the day, Manitoba Hydro uses the stored water, and sells some of the energy back to the neighbors. Since the last increment of thermal energy in the neighboring systems is usually relatively expensive,

figure 4.11 ***Prices Obtained for Surplus Energy***
figure 4.12 ***Extra Provincial Energy Sales***



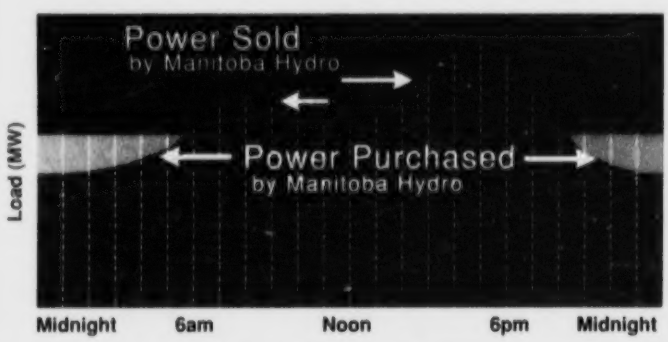


typical daily load curve

typical thermal utility marginal cost curve

Thermal utilities will usually run their lowest cost units on base load, and then add more expensive units as the load increases. As the load decreases, the higher priced units will be dropped off.

During low load periods, usually during the night, the next block of power is relatively cheap. During high load periods, usually during the day, the next block of power is relatively expensive.



Manitoba Hydro's use of its reservoirs allows storage of this low cost night time energy so that it can displace high cost day time energy. After allowing for the cost of energy lost in transmission, the thermal utility is able to save on its fuel costs, and Manitoba Hydro is able to make a profit on the transactions.

this energy can be sold at much higher prices than it was bought for. Under this type of arrangement both utilities benefit. See Figure 4.13.

4.2.2 Future Operations

With the Limestone Generating Station's first units coming into service in 1990, the amount of surplus energy available for export will increase in the early 1990s and then reduce towards the end of the decade. Figure 4.14 illustrates both the predictable and the potential amounts.

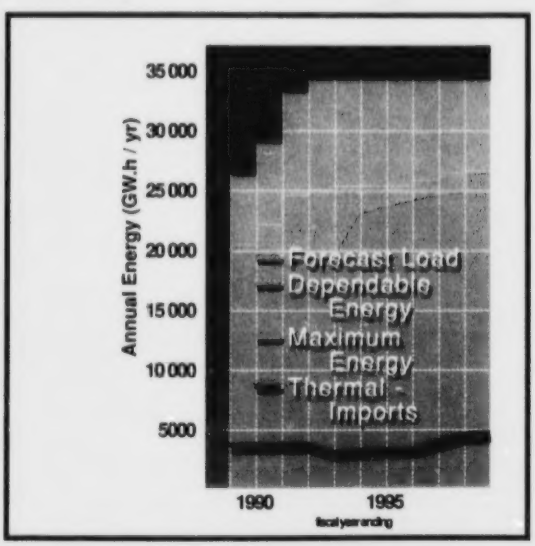
This energy will continue to be offered for sale to the highest bidder among interconnected utilities.

Since load growth in the U.S. utilities is currently higher than expected, and very little new generation is planned, the prices obtained for surplus energy should improve as these utilities are forced to operate less efficient plants. Also, the cost of coal is forecast to increase modestly in the early 1990's, and this should also be reflected in the price of energy.

The actual prices obtained will continue to be established on a day-to-day basis and will vary considerably depending upon the circumstances prevailing at the time.

figure 4.13 ***Import/Export Transactions under Modest Drought Conditions***

figure 4.14 ***Surplus Energy Contribution of Limestone***



4.3 Firm Export Commitments

Firm export commitments are an entirely different kind of export transaction from surplus energy sales. In these cases, the exporting utility agrees to supply the importing utility with the specified service for a specified period. The benefit to the importer is usually that they can defer construction of new plant, while the benefit to the exporter is usually that they can sell more of the output from a plant that is larger than they need immediately for their own load.

Careful negotiation and coordination of activities can result in significant benefits to both utilities.

A particularly valuable form of agreement, especially between summer-peaking U.S. utilities and winter-peaking Canadian utilities is the diversity exchange. In these cases, the Canadian utilities export power and energy in the summer from plants that would otherwise sit idle, and import in the winter months from U.S. plants that would otherwise sit idle. The result is that both utilities can defer new plant, with resultant savings to customers of both utilities.

Manitoba Hydro is an active participant in the export market, the objective being to reduce the long term cost to Manitoba Hydro customers.

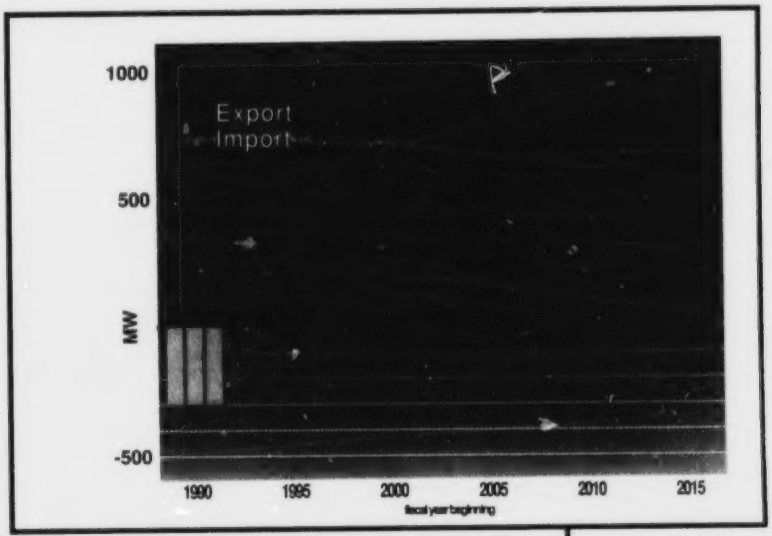


figure 4.16 ***Firm Import/Export Commitments***

4.3.1 Marketing Responsibility

Under the Manitoba Energy Authority Act the "Electrical Energy Marketing Committee" was created: (a) to investigate potential extra-provincial markets for electrical energy, and (b) to negotiate or direct negotiations for the sale or purchase of electrical energy exported from or imported to the province. These functions are carried out by the staff of Manitoba Hydro and the Manitoba Energy Authority.

4.3.2 Current Contracts

There are currently six agreements in force with Northern States Power Company, one with United Power Association, and two with Ontario Hydro, involving the import or export of firm energy or capacity. Four of these agreements require further approval from the appropriate governments and/or the National Energy Board.

These are summarized in Figure 4.15. Figure 4.16 shows the net effect of all these transactions for the winter periods from 1989 through 2016. This load is treated as a firm load by Manitoba Hydro, and in all energy supply activities it is considered on the same basis as the domestic load. In those years where a net import is shown, the import is considered to be a firm source of supply.

4.3.3 Potential Sales

Discussions are continuously being carried on with neighboring utilities.

Export opportunities are evaluated to determine their effect on Manitoba Hydro and are ranked in the order of economic benefit to Manitoba Hydro customers and the financial impact on Manitoba Hydro. Export opportunities with United States utilities or Canadian utilities will be negotiated where a clear business case can be made, demonstrating that the export arrangement will result in rates for Manitoba consumers being lower than they would have been without the sale.

figure 4.15 ***Current Export Agreements***

Utility	Type	Duration	Amount
NSP	Firm Power Summer Sale *(May through October)*	1980-92	200MW @ 20% monthly Capacity Factor
NSP	Diversity Exchange	1980-92	300MW @ 20% monthly Capacity Factor
NSP	Firm Power Sale	1993-2005	500MW @ 75% annual Capacity Factor
NSP	Firm Power Summer Sale *(May through October)*	1993-96	200MW @ 20% monthly Capacity Factor
UPA** *	Diversity Exchange	1995-2015	150MW @ 20% monthly Capacity Factor
NSP** *	Diversity Exchange	1995-2015	150MW @ 20% monthly Capacity Factor
NSP*	Diversity Exchange	1996-2016	200MW @ 20% monthly Capacity Factor
Ontario Hydro	Firm Power Sale	1998-2003	200MW @ 80% annual Capacity Factor
Ontario Hydro**	Firm Power Sale	2000-2022	1000MV/ @ 65% annual Capacity Factor

subject to receipt of a licence from N.E.B.
****subject to regulatory approval***

Some of the most important decisions Manitoba Hydro must make concern the nature and timing of additional plants to meet predicted requirements. The identification of a preferred option is a difficult process, complicated by all the uncertainties surrounding the future.

Decisions to construct additional plants or purchase extra-provincial power do not have to be made every year. However, the Corporation must have a long range plan; consequently the assessment of future options is a continuing function.

The approach adopted involves a very systematic, and rigorous, analysis. It is also cyclical, in that it is repeated annually, with the results of previous analyses being used to help direct the next one.

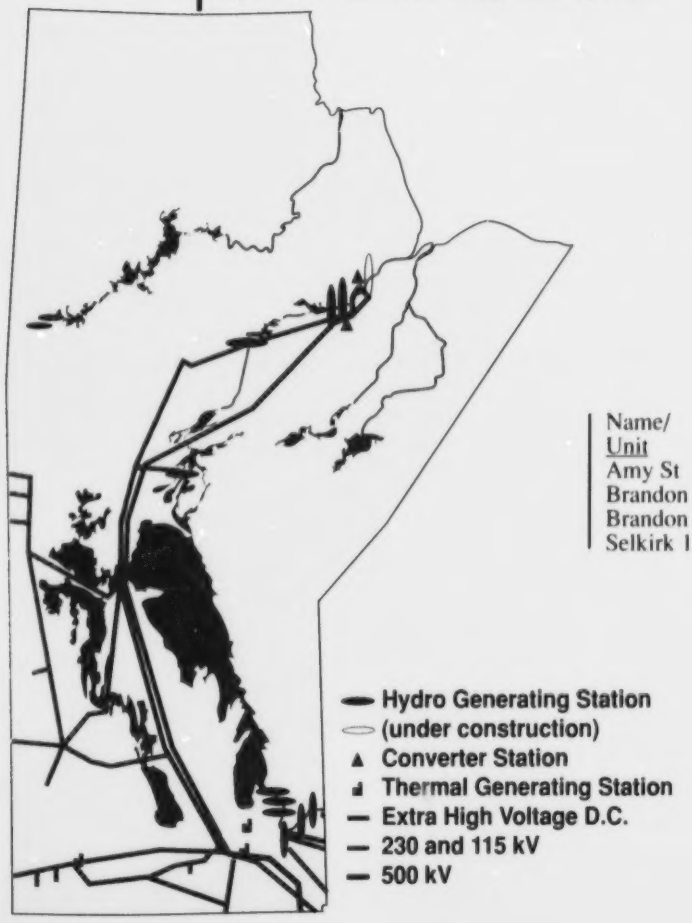
In the case of generation planning, the outcome is what is known as the base case generation sequence, with a group of alternative sequences that could be implemented if conditions turn out to be different from those assumed.

5.1 The Need for Additional Generation

Additional sources of energy and capacity are required from time to time to meet the increasing domestic load and any firm export contracts.

Simply stated, the capability of the existing system is compared to forecast requirements. The forecast date when the capability is exceeded is when new sources are required.

figure 5.1 ***Manitoba Integrated System***



5.1.1 The Current System

Manitoba Hydro and Winnipeg Hydro operate an integrated system to supply Manitoba from thirteen hydro plants with a total capability of 3 548 MW and three thermal plants with a total capability of 404 MW.

The useful life of a coal-fired plant is of the order of 30 to 40 years, and all three thermal plants are of this vintage.

They currently have anticipated retirement dates as follows:

Name/ Unit	Rating MW	Commissioned	Retirement Date
Amy St	35 (3 units)	1924-1954	June 1990
Brandon 1-4	33 each	1957-1958	March 31, 2000
Brandon 5	105	1969	March 31, 2006
Selkirk 1,2	66 each	1960-61	March 31, 2000

Hydro stations, on the other hand, have useful lives of the order of 100 years, and no plant retirements are currently scheduled.

Manitoba's supply is augmented by a seasonal diversity agreement with NSP which provides 300 MW of winter capacity until 1993. The 1 330 MW Limestone Generating Station is under construction, with first power expected in 1990. Two new diversity exchanges of 150 MW and 200 MW with NSP will start in 1995 and 1996 respectively, and one of 150 MW with UPA will start in 1995. All three will last for 20 years.

By 1992, after Limestone is completed, the sys-

tem capability will be approximately 5 500 MW, as follows:

1992 Operating Capacity MW	
Winnipeg River (6 generating stations)	560
Grand Rapids	440
Jenpeg	102
Kelsey	216
Laurie River (2 generating stations)	10
Kettle	1 200
Long Spruce	970
Limestone	1 330
TOTAL HYDRO	4 828
Brandon & Selkirk Thermal	369
NSP Diversity	300
SYSTEM CAPACITY	5 497

It should be noted that these operating capacity figures represent the net capacity available from each plant under peak load conditions, and are the correct figures to use for planning purposes. In many cases this differs from the "name-plate rating" which is often used in other Manitoba Hydro publications.

The Transmission System is interconnected by eleven extra-provincial tie lines to utilities in the neighboring provinces and in the U.S. The combined export level is 1 600 to 1 800 MW over these lines.

The major transmission network in Manitoba consists of two high-voltage direct current (HVDC) transmission lines (operating at ±450 kV and ±500 kV respectively with a total capability of 3600 MW) connecting northern generating stations on the Nelson River to southern load. Bulk transmission throughout the rest of the Province consists of a network of 230 kV, 138 kV and 115 kV lines.

Figure 5.1 shows the existing integrated system.

5.1.2 Predicted Load

The predicted energy load is summarized in Figure 5.2. Included are the loads within Manitoba and the firm export commitments to Northern States Power, United Power Association and Ontario Hydro. Also shown in this figure is the system's dependable capability that is either in place or under construction and the approximately 500 GW.h/yr targeted for conservation by 2001 through DSM programs.

The predicted peak capacity requirements are summarized in Figure 5.3. In addition to the base forecast and targeted conservation, high and low scenarios are also shown, and all four can be compared to the system capacity.

Further uncertainty in these load forecast scenarios arises because of unpredictable weather variations and because of large loads unexpectedly materializing or ceasing to exist.

5.1.3 Supply/Demand Balance

The energy and capacity supply/demand figures 5.2 and 5.3 show that the existing generation, with the addition of Limestone, will be adequate to supply the base load growth until about 1999/2000. Energy in excess of load requirements will be sold as short term firm sales or as interruptible energy on the export market.

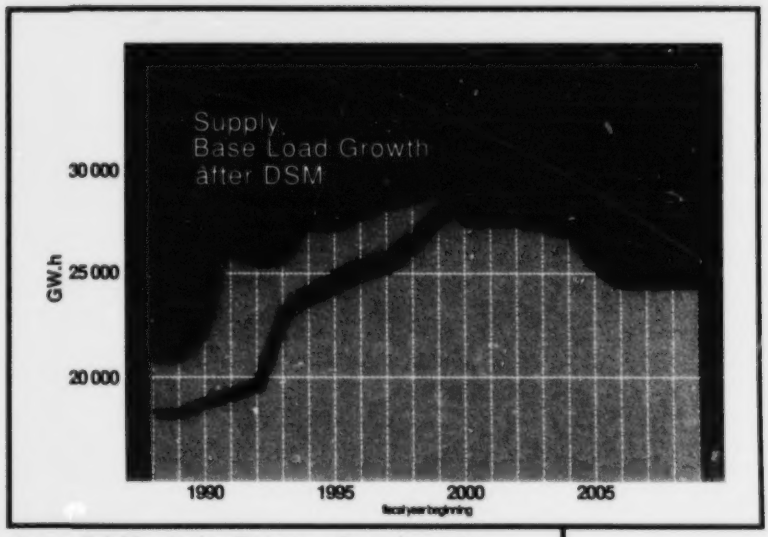


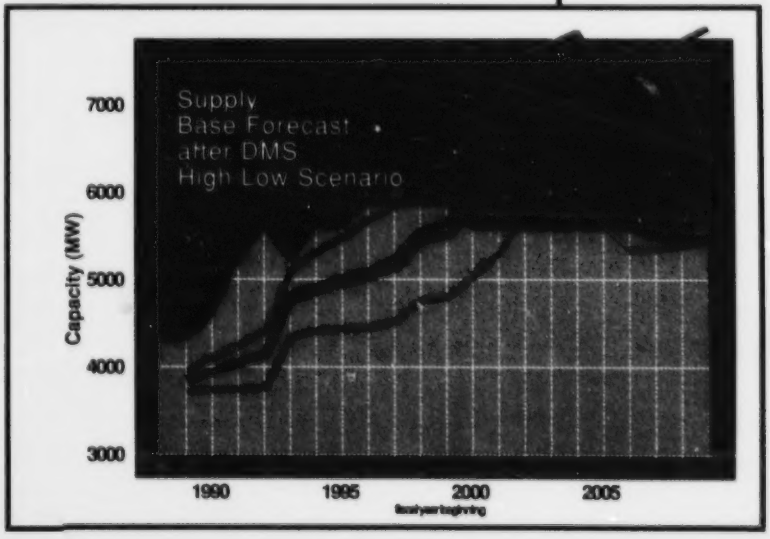
figure 5.2 ***Manitoba Energy - Supply and Demand***

Surpluses fluctuate from year to year as loads grow, firm export sales begin, and import transactions end and new ones start. The supply reductions in 2000 and 2006 would occur if the thermal plants at Brandon and Selkirk were to be retired.

New sources must be added when capacity or energy surpluses are depleted. New generation will be required in 2000 for both capacity and energy.

If load growth is higher than the base forecast, new capacity would be required earlier. If load growth were to be lower than the base forecast, supply additions could possibly be deferred.

figure 5.3 ***Manitoba Peak Load - Supply and Demand***



5.2 Planning Assumptions and Criteria

In planning the development of its generation and transmission system, Manitoba Hydro applies certain criteria which the system must satisfy. In addition, Manitoba Hydro must make assumptions regarding the occurrence of natural events, the circumstances of its neighbors, and regulatory requirements. Many of these assumptions and criteria are explained throughout Perspective 2000, but several are sufficiently important to warrant specific mention.

5.2.1 Historic River Flows

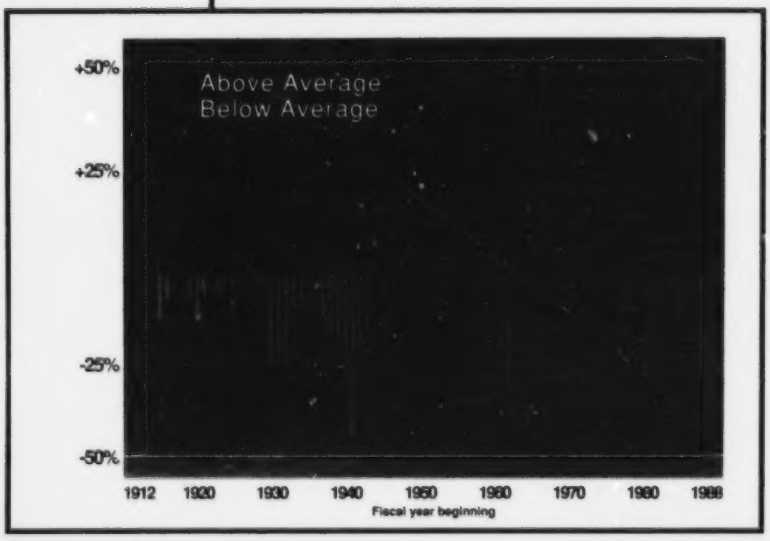
Manitoba Hydro produces, in most years, over 95% of its energy from hydraulic generating stations.

In a drought, the availability of this energy can drop by 25% to 30% below the average level, and in order to satisfy load, supply must be supplemented by increased thermal generation and imports.

The generation system is planned to be capable of supplying forecast load energy under a repeat of the lowest historic river flows; this is called Manitoba Hydro's dependable energy criterion, and it is an implicit assumption that future river flows will not be less than the lowest recorded. The lowest flow in the Manitoba hydraulic system, recorded since 1912, occurred in the year from April 1940 to March 1941. Refer to Figure 5.4. Flows for 1988/89 were very close, but slightly higher than the 1940/41 flows.

Possible system expansion plans are tested against a repeat of this extremely dry period to ensure a dependable energy supply to satisfy load demand. The month-by-month operation of the future generating system is modelled by computer over the entire range of historic inflows. Generating stations, water in storage in forebays and major reservoirs like Lake Winnipeg and Southern Indian Lake, as well as the diversion of the Churchill River into the Nelson River are modelled.

figure 5.4 ***Total Water Flow, Manitoba Hydraulic System***



It should be noted that none of the major rivers supplying Manitoba Hydro's hydraulic generating system still has natural flows. Major control structures create large reservoirs on each of these rivers (see Figure 5.5) that permit moderation of the consequences of extreme natural flows. This moderating effect is considered when establishing the dependable flow regime.

Energy shortfalls under this regime would indicate the need for generation addition or other supply system improvements.

5.2.2 Future River Flows

Climatologists generally agree that there is a gradual global warming trend primarily attributable to the so-called "Greenhouse Effect". There is some dissenting opinion, and there is no general agreement as to the rate and extent of the warming trend, particularly in respect to specific regions.

A plausible and reasonable mid-range scenario for Manitoba Hydro's area of interest (see figure 5.6) appears to be:

–Summer temperatures will rise about 1/2 to 1 °C per decade

–Winter temperatures will rise about 1 to 2 °C per decade

–Summer precipitation will decrease

–Winter precipitation will increase

These are all offered as average effects, and substantial year-to-year variations would continue to be experienced.

The net effect of these changes, if they occur, and allowing for the increased evaporation due to warmer weather, would be to reduce average river flows. There would still be floods and droughts, but the overall effect will be a reduction in water supply to Manitoba Hydro's hydraulic generating stations.

A second potential cause for reduced future flow is the possibility of increased consumptive use. Consumption for irrigation, municipal, and industrial purposes is not significant today and is not expected to become a factor this century. However, it may become more important in the 21st century, particularly if the prairies do become hotter and drier due to a greenhouse effect.

At present, Manitoba Hydro does not incorporate these potential reductions in river flows into its planning assumptions. It is not clear if indeed there will be a reduction, or how much of a reduction, or if the reduction would apply to all flow conditions, including low flow conditions.

It is, however, an area of concern to the Corporation. Preliminary assessments are that reductions in average river flows of about 10% would not indicate the need for any change in Corporate direction.

Manitoba Hydro fully recognizes the potential problems inherent in this phenomenon, and is actively cooperating with other interested groups who are attempting to predict future climatic conditions.

5.2.3 Reserve Capacity

In planning generation additions, a minimum reserve capacity of 12% of forecast firm peak load is required. Manitoba Hydro may also provide reserve capacity for firm export sales, depending on the terms of particular contracts.

Capacity reserves are intended to protect against shortages resulting from the breakdown of generation equipment or from higher than expected loads due to unusually cold weather or to load growth being greater than forecast.

5.2.4 Reliance on Neighboring Utilities

Manitoba Hydro can rely on supplies from external sources for capacity and dependable energy.

Imports and seasonal diversity exchanges, for which there is a contractually agreed price and delivery schedule, are counted as firm capacity and dependable energy sources.

In addition, planned dependable energy supply may include a limited amount of non-firm energy imports, i.e., for which the supplier reserves no generation and neither price nor delivery schedule is specified. Non-firm imports are limited to approximately 10% of forecast energy demand and the volumes of such non-firm imports must be contractually agreed upon.

Examples of contracts for firm supplies from external sources are the present 300 MW and the future 200 MW diversity exchanges with NSP, while examples of non-firm imports would be the various energy guarantees attached to transactions with Ontario Hydro and NSP ranging from 800 GW.h/year to 1500 GW.h/year.

5.2.5 Transmission Planning Criteria

With respect to the HVDC transmission system, the planning criterion is to provide spare capability to meet the Manitoba firm load demand in the event of outages of up to 1 000 MW in HVDC transmission or at terminal stations. 1000 MW is the capability of one of the poles in a HVDC bipolar transmission line.

The major 115, 138 and 230 kV AC transmission system is planned to supply forecast loads and firm exports, while operating safely and reliably under normal conditions and in the event of breakdown of any single piece of generation, transmission or terminal station equipment.

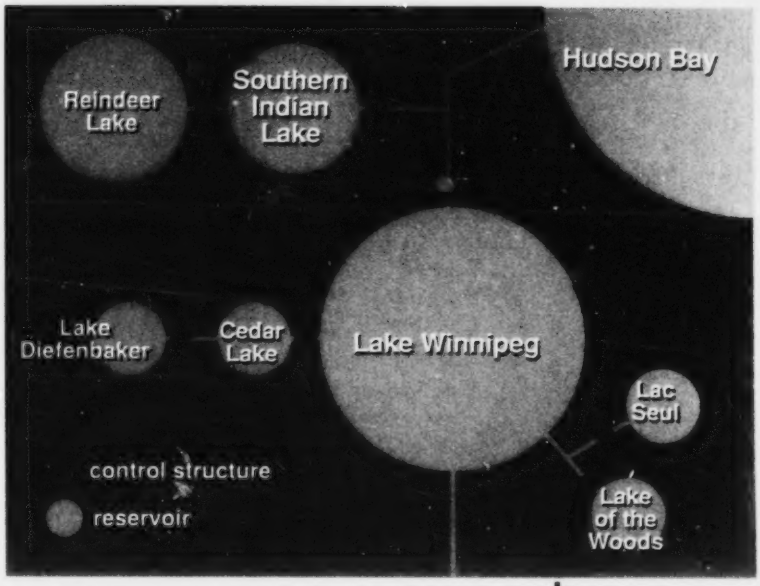


figure 5.5 ***Reservoirs and Control Structures***

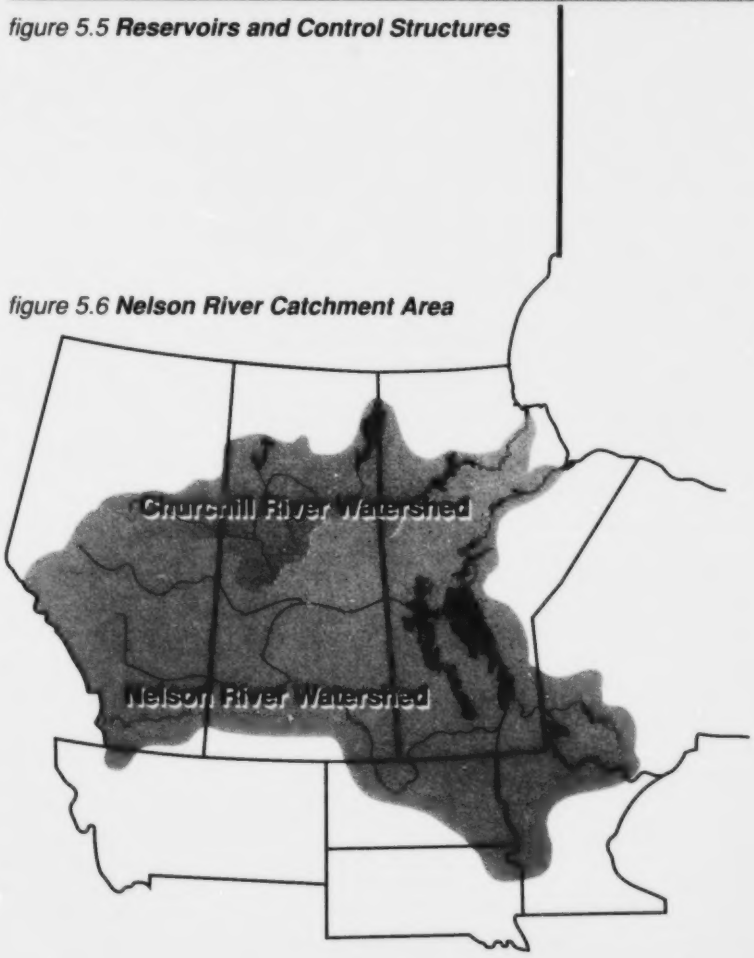


figure 5.6 ***Nelson River Catchment Area***

5.3 Options for Supply

Having ascertained the need for additional sources of supply, and the conditions under which the additional supply will be required, all options for satisfying that need are identified and evaluated. In Manitoba, the two main types of options are either hydraulic generating stations or coal-burning thermal generating stations. Other options such as long or short term imports and gas turbine generators are also considered.

5.3.1 Hydraulic Options

After Limestone Generating Station comes into service, about 4 500 MW of readily available hydroelectric potential will still be undeveloped in Manitoba.

This potential is concentrated at nine hydraulic generation sites along the Nelson and Burntwood Rivers. Figure 5.8 shows their geographical location.

Major Potential Hydraulic Sites

Name	Capacity* MW	Average Energy* GW.h/yr	Relative Energy Cost Cents/kW.h**
Lower Nelson:			
Conawapa	1 290	7 045	4.9
Gillam Island	850	4 980	7.3
Gull	535	2 900	6.2
Birthday	540	3 265	6.0
Upper Nelson:			
Whitemud	310	1 700	9.0
Red Rock	190	1 160	11.3
Burntwood:			
Wuskwatim	350	2 200	5.5
Manasan	215	1 670	9.0
First Rapids	250	1 400	7.4

* Capacity and Energy figures are approximate only, and final developments will probably differ. Figures also include adjustments when necessary to recognize losses at upstream plants caused by the creation of the forebays at added plant.

** For the purpose of comparison, all generating plant costs have been calculated based on an assumed 1999 in-service. The figures refer to generation costs only; transmission costs are not included.

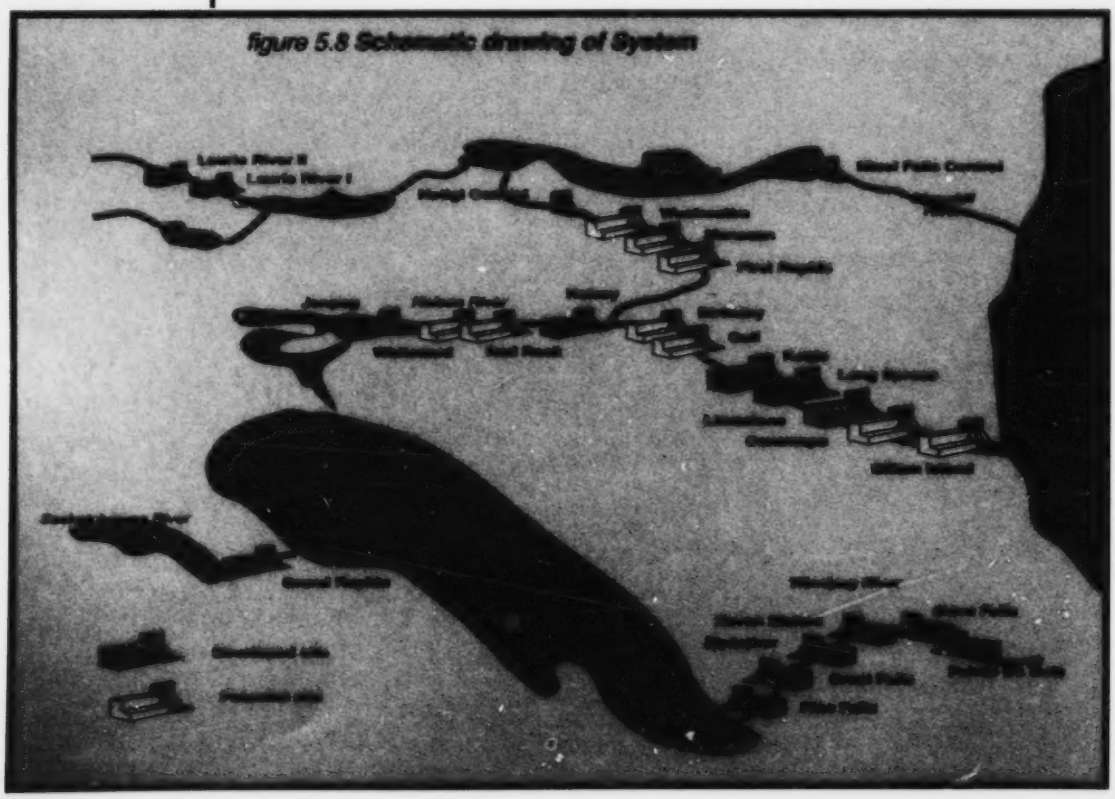


figure 5.8 Schematic drawing of System

The site with lowest average energy cost is Conawapa.

Approximately 4 500 MW of further undeveloped hydroelectric potential is dispersed over 75 small to medium sized sites throughout the province. Many of these sites may not be developed for a long time, if ever, because their small size and remoteness from the transmission grid makes them uneconomical compared to other supply options.

5.3.2 Thermal Options

Thermal generation, either by building new facilities or postponing the retirement of existing units, is a supply option.

The present plan is to ensure the 2-66 MW units at Selkirk and the 4-33 MW units at Brandon achieve at least their anticipated retirement dates in 2000, and that the 100 MW Brandon #5 unit will remain until 2006. This will require refurbishment of generators, turbines and boilers, possibly the addition of emission controls like cooling towers and electro-static precipitators, and modifications to coal unloading facilities.

Preliminary information suggests that a ten-year extension to the service lives of the Brandon and Selkirk plants is possible, and these extensions are considered as an option in the generation sequence. Refurbishment of Winnipeg Hydro's Amy Street plant is not feasible, and it will be retired in 1990.

A new thermal plant of 200 to 400 MW is a planning option, but has not proven in evaluations to be an economic alternative as the next generation addition.

Thermal generation in the predominantly hydraulic Manitoba system provides peaking capacity for area support and stability, as well as dependable energy during periods of low stream flows. Due to relatively high fuel costs, however, thermal generation cannot compete cost effectively against hydro as a bulk energy producer.

5.3.3 Other Supply Options

Other supply options exist and are considered regarding their suitability to meet Manitoba Hydro's requirements and their cost effectiveness in the generation development plan.

Imports, in the form of capacity purchases, energy guarantees, and seasonal diversity arrangements can delay the installation of new generation, relieve shortages when capacity is depleted due to unexpected load increases, and firm up the system in the event of droughts. Imports can result in short-term savings, but since generation costs are generally lower in Manitoba than in neighboring utilities, commitment to long-term imports has been found not to be an economic option.

Gas or combustion turbines have lower capital costs than either hydro or coal-fired thermal plant, but have high fuel costs. When a plant addition is required for capacity rather than for dependable energy, these plants would not be expected to run very often and could, therefore, be an attractive option in providing peaking capacity. Gas turbines can be installed quickly, in two to three years, and can be effective short-term solutions if load demand rises faster than anticipated. They are not, however, an economic planned alternative to major hydraulic generating stations.

Equipment modifications to improve the capability of the existing system could defer future generating plants. Replacing the turbine blades in older generating stations, for instance, could add in excess of 100 MW to the capability of the system, equivalent to about one year's load growth. The modification of a few of these units has already been undertaken, and the economics of further units are being evaluated.

Nuclear plants appear to present unsolved long-term waste disposal concerns. Economics also favour hydraulic development over nuclear.

Other options like solar, biomass, wind, small hydro, and fuel cells are at present very expensive compared to hydro, while supply sources like geothermal and tidal power are not options in Manitoba.

To date, cogeneration has been attractive to two of Manitoba Hydro's customers who create large amounts of waste process heat. Manitoba Hydro purchases surplus energy in small quantities from customers with their own generation facilities at published domestic rates. Proposals for the purchase of firm or interruptible energy in larger quantities, from independent power producers using cogeneration equipment, are encouraged, and evaluated on the basis of avoided system cost or value. Any such purchase must meet Manitoba Hydro's needs and standards for reliability, quality, safety, and environmental protection.

Independent power production outside of cogeneration has not been viable to date, because of high fuel prices relative to electricity rates. Proposals from independent power producers for future supplies are considered, and would be attractive if the power is offered at less than avoided cost.

Demand-side management is a quasi-supply option. By changing the load demand, through incentives to the consumer, the need for new generation may be influenced and an optimal system development might be achieved. Manitoba Hydro is starting to incorporate demand-side management options into the least-cost planning of its system, and anticipates that within a few years selected conservation programs will be found to be viable.

It is anticipated that the combination of Demand Side Management programs and non-utility generation will contribute about 100 MW by the year 2001.

5.4 Selection Among Options

Each of the available supply options has different characteristics and implications. Thus the selection becomes an "apples versus oranges" type of decision where direct comparisons are very difficult to make. The solution is to consider the alternatives in the light of several broadly grouped factors. Not ranked in any particular order of importance, these are:

-Economic and financial
-Technical
-Environmental and social
-Uncertainty and risk
-Constraints due to agreements and licences

5.4.1 Economic and Financial Factors

Investment decisions must be based on economics. Evaluations of sequences of development are typically made looking ahead 30 to 40 years to determine the least costly option in terms of costs versus revenues. The parameters which affect the economics of sequence are capital costs of new facilities, fuel and other operating costs, timing of plant additions as determined by the load forecast, revenues from existing and proposed firm sales and from interruptible exports, interest rates on borrowed money, and the rates of escalation of various cost components.

The financial situation of the Corporation could be affected differently by each sequence option because of variations in capital requirements, interest charges, operating costs and export revenue flows.

A second type of economic factor is the impact of a potential project on the level of economic activity in the province. The construction of a generating station provides a stimulus to communities close to the project and to the province as a whole. Alternative projects would have different impacts.

5.4.2 Technical Factors

Any proposed addition to the generation and transmission system must meet technical standards, and be reliable and adequate for the load requirements.

Flexibility of operation of the system has to be considered when selecting between plant options of different ratings or at different locations.

Operating constraints on existing generating stations during the development phase of a river system are typical of the technical factors that must be considered.

5.4.3 Environmental and Social Factors

Each plant and transmission option has unique impacts on the environment and on the socio-economics of communities affected by the projects. These impacts are considered when selecting among alternatives. Where possible, undesirable environmental effects are avoided. Unavoidable effects are mitigated to the extent reasonably possible.

In addition to specific concerns about the environmental and socio-economic effects, communities have general concerns and opinions which must be addressed in dialogue between Manitoba Hydro and community leaders and other persons affected by the project.

5.4.4 Uncertainty and Risk Factors

Planning risks arise from the need to make decisions to build generating plants and major transmission up to ten years in advance without having perfect foresight. Decisions based on a given forecast of loads, including the success of demand-side options, of export prices, or of economic indicators such as inflation, may prove not to be optimal if these forecasts change. While planning risk factors can be defined, to some degree, by appropriate sensitivity analyses, a degree of risk will always be present.

Construction risks are unique to each plant option. Each plant concept has its own potential problems and uncertainties in regard to both costs and schedule flexibility in case the program needs to be accelerated or slowed down.

5.4.5 Constraints due to Agreements and Licences

Generation development is subject to various legal agreements and licences. Selection among options must consider, for example, factors like the Northern Flood Agreement, the Churchill River Diversion Water Licence, the City of Thompson Agreement, and Emission Control Licences at thermal generating stations.

5.5 Development Plan

The products of the selection phase are a preferred development plan and, when necessary, a decision regarding the next plant. The preferred development plan identifies the location, size and timing of the most likely sequence of new generation and transmission facilities. The existence of this plan does not necessarily imply a commitment to the sequence shown. More realistically it shows the preferred direction and gives some idea as to when commitments will likely have to be made.

5.5.1 Current Schedule for New Generation

Limestone Generating Station is under construction, with first power scheduled in November 1990, and all units scheduled to be in service in 1992.

The next supply addition is currently forecast to be required in 2000. The Ontario Hydro 1000 MW sale and the 150 MW diversity exchanges with NSP and UPA are subject to regulatory review and approval in both Manitoba and the neighboring jurisdictions. If all the necessary licences and approvals for the diversity exchanges are not received, a 1999 in-service date would probably be required. If the Ontario Hydro sale licences and approvals are not received, but those for the diversity exchanges are, then the requirement for new generation would likely be deferred beyond 2001. The supply system development sequence shown in Figure 5.9 is currently preferred under the expected conditions, and includes Conawapa as the next hydro plant. In fact, Conawapa is favored under most scenarios, but there are other, albeit less plausible scenarios, including failure to obtain regulatory approval of the Ontario Hydro sale, where Wuskwatim might be preferred. Consequently, no final commitment to either option has yet been made.

figure 5.9

Base Case Generation Sequence

1990 to 2000		
1990	retire Amy Street	-35 MW
1990-1992	add Limestone G.S.	1330 MW
1993	refurbish Brandon 1-5	—
1993	refurbish Selkirk 1-2	—
2000-2002	add Conawapa G.S.	1290 MW
2000 to 2010		
	retire Brandon 1-4	-132 MW
	retire Selkirk 1-2	-132 MW
	retire Brandon 5	-105 MW
	add Wuskwatim G.S.	350 MW

If Conawapa proceeds for 2000 as expected, Wuskwatim will not necessarily be the next plant. This decision would probably not be required until the mid 1990s, and other options, such as Birthday or Gull, could also be contenders.

5.5.2 Generation Options Being Retained

Generation planning studies, conceptual designs, exploration work and environmental activities are proceeding simultaneously to protect both Wuskwatim and Conawapa as options, until a firm in-service date is established, and one is selected and the other delayed in the program.

Conawapa would require 10 years from commitment to deliver first power, one year longer than Wuskwatim. The deadline for the plant selection is, therefore, governed by the Conawapa schedule. Transmission requirements from the generating sites are unique to each site and are a factor which must be considered. It is necessary to provide adequate time for the environmental studies and processes. On the other hand it is necessary to avoid spending money so early that the information becomes outdated, and to avoid significant spending on an option that will not be selected. If Conawapa is chosen for a 2000 in-service date, a 1990 decision date is required.

If the selection is delayed, or a 1999 in-service date becomes necessary, the option is not necessarily lost. Either significant expenditures on some of the preliminary work would have to precede the selection, with the risk that it later becomes redundant, or the construction schedule would have to be compressed. In this case, the risk of not meeting the target in-service date would be increased, and the cost of the project under an accelerated program would probably be higher.

A commitment to the construction of Wuskwatim under a normal schedule would not be required before 1991. The risks associated with Wuskwatim are less in the construction and more in the areas of environmental and regulatory requirements. Wuskwatim could affect the flow patterns and water levels in the Burntwood River which would be of concern to communities in the vicinity. The project is subject to the Northern Flood Agreement and the operating licence for the Churchill River Diversion. Dialogue with affected communities to explain the project has been initiated.

Rehabilitation of the Brandon and Selkirk thermal plants, sufficient to ensure that they achieve their anticipated retirement dates, is planned to commence in 1990. A comprehensive study, currently in progress, is investigating the incremental requirements and costs involved in extending their service lives. Analysis by Manitoba Hydro of the resulting costs and benefits will show whether the various units should be retired.

Gas combustion turbines are a backup option in case load growth suddenly exceeds planned supplies due to increases unforeseen in the load forecast. Gas turbines are also a backup option in case of catastrophic equipment failures. If power purchases cannot be arranged, and it is impossible or uneconomic to advance other generation, then combustion turbines can be installed in two to three years.

Discussions with potential non-utility generators are ongoing.

Other related studies will continue to provide information that will facilitate and support the plant selection:

–Studies are continuing on the technical and economic feasibility of replacing turbine blades at Kettle generating station and in selected units at Winnipeg River plants in order to increase plant capacities.

–Field explorations, plant siting and preliminary design studies are in progress for two prospective Nelson River hydro plants, at Gull Rapids (535 MW) and Birthday Rapids (540 MW).

–Evaluations of alternative generation sequences will continue with ever-changing forecasts of capital costs, discount rates, interruptible prices, and domestic loads, and with new firm import or export opportunities.

5.5.3 Transmission Development Plans

Limestone Transmission

Limestone Generating Station in 1990 requires transmission from the powerhouse to the high-voltage terminal at Henday, and it requires additional equipment at the receiving terminal of the Nelson River transmission system at Dorsey near Winnipeg. The existing HVDC transmission capability from the north to southern Manitoba is adequate, and no new HVDC lines need be built to carry Limestone power.

HVDC Rehabilitation

A staged replacement program for the older, less reliable components of the high-voltage direct-current (HVDC) transmission system from the Nelson River is underway. Over the next 10 to 15 years, certain terminal station equipment will be replaced and the capability of the existing transmission upgraded from 3600 MW to 4000 MW.

Conawapa Transmission

Conawapa Generating Station in 2000 will require transmission from the powerhouse to the high-voltage terminal at Henday and a new high-voltage direct-current (HVDC) transmission line, 800 to 900 km long, from a new Nelson River terminal (at Henday) to Riel, east of Winnipeg. Site selection and environmental assessment work for this project has commenced.

Wuskwatim Transmission

Should the Wuskwatim generating station be selected in preference or in addition to Conawapa, the 230 kV high-voltage transmission network in the Flin Flon-Thompson-Grand Rapids area will require reinforcement and extension. A total of about 470 km of line with associated stations would be involved.

Silver Station

A new terminal station to supply subtransmission in the Interlake area is being built for service in 1990, at Silver, approximately 35 km northwest of Gimli. A 230 kV high-voltage line, 60 km long, will be constructed to the vicinity of Eriksdale to feed the new station.

Reston-Virden-Birtle-Raven Lake Transmission

A 130 km-long 230 kV high-voltage transmission system from Reston to Raven Lake, looping through Virden and Birtle, will be built in stages over the next ten years. Intermediate stations at Virden and Birtle will reinforce the supply to the western area of the province.

Winnipeg-Brandon Transmission

A 192 km-long 500 kV extra-high-voltage transmission line is planned for the late 1990s between Winnipeg and Brandon. This transmission would be required to provide additional support to the Brandon area especially if the 132 MW of thermal generation at Brandon were to be retired at that time. The plan could be modified if the service life of thermal generation were to be extended.

Seven Sisters-Kenora 115 kV Transmission

A new substation to serve the West Hawk/Falcon Lake area was built in 1989 near Star Lake, and will be supplied from the Seven Sisters-Kenora 115 kV transmission line. Reconstruction of the Manitoba portion of this 50-year-old transmission line is required because of deterioration of poles and wires, and will be completed in 1990. The line will provide local supply and will also continue to function as an interconnection with Ontario.

North Central Manitoba Transmission

A 312 km-long 138 kV transmission line, scheduled for completion in 1995, is tentatively planned to connect the Oxford Lake, Island Lake and Gods Lake communities to central system supply at Kelsey.

5.5.4 Interconnection Development Plans

Ontario Transmission

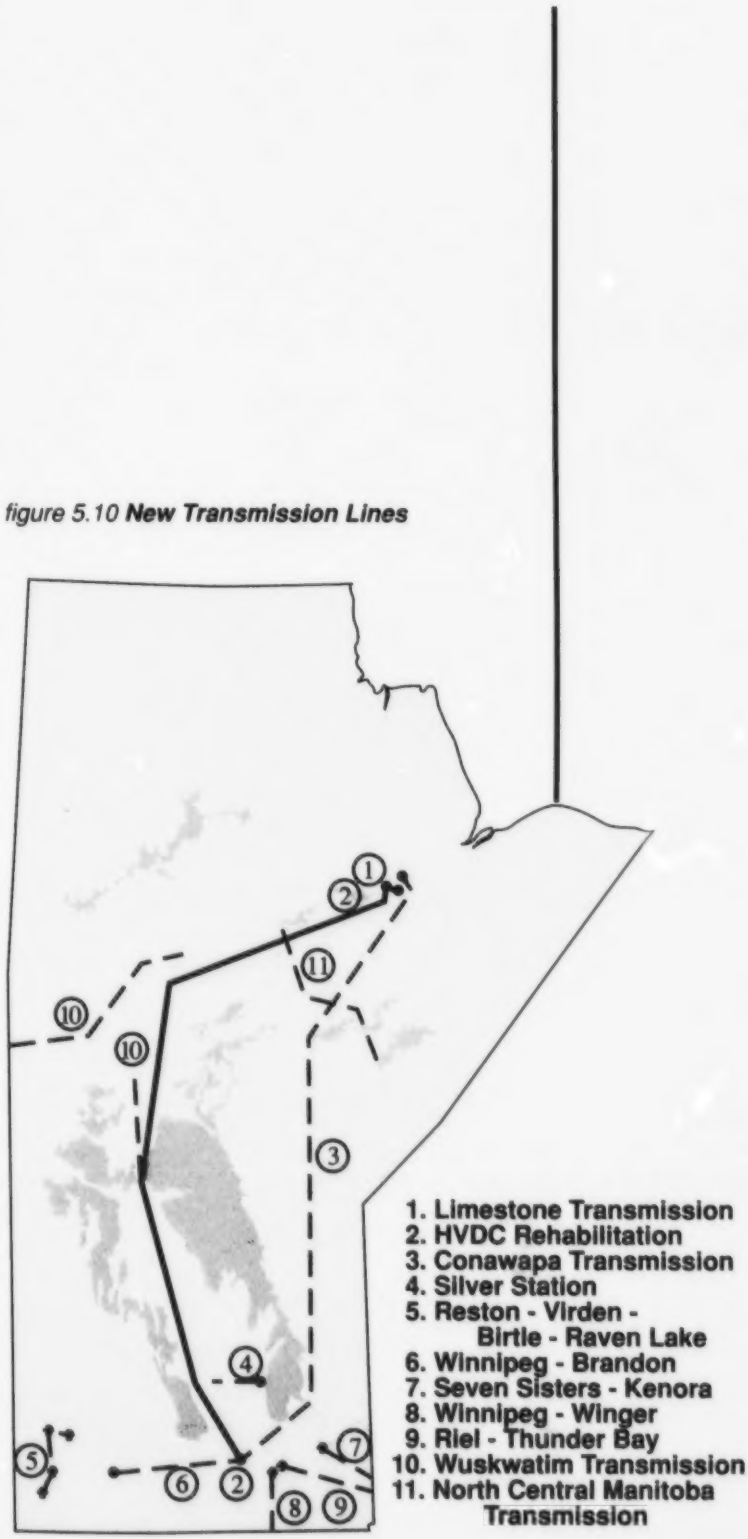
A new 140 km transmission line from Riel Station near Winnipeg to the Ontario border will be required to support the new sales agreement with Ontario. This will be a 500 kV extra-high-voltage line together with the associated switchgear at Riel, and will go into service in 2000.

Winnipeg—Winger Transmission

A 230 kV high-voltage transmission line is planned to be in service in 1995 to accommodate the 150 MW diversity exchanges with UPA and NSP. This line will originate near Winnipeg and will terminate at Winger, Minnesota. Manitoba Hydro will be responsible for the 100 km in Manitoba, plus the switching facilities.

Figure 5.10 shows the approximate location of these new transmission facilities.

figure 5.10 ***New Transmission Lines***


1. Limestone Transmission
2. HVDC Rehabilitation
3. Conawapa Transmission
4. Silver Station
5. Reston - Virden - Birtle - Raven Lake
6. Winnipeg - Brandon
7. Seven Sisters - Kenora
8. Winnipeg - Winger
9. Riel - Thunder Bay
10. Wuskwatim Transmission
11. North Central Manitoba Transmission

Corporate Citizenship 6.0

In common with other organizations, Manitoba Hydro is both a creation of and a participant in the society it serves. In some cases, the way it acts becomes as important as the actions themselves.

Manitoba Hydro recognizes that there can be significant impacts resulting from its activities, not only in the energy related areas of its work, but also from activities that are not directly related to the supply of energy. The latter includes such diverse issues as employment programs, economic development and procurement programs, native issues, and so on.

Manitoba Hydro considers that being a "good corporate citizen" is an integral and important part of its mandate, and that this in part involves striking a balance between the interests of various affected or specific groups, its customers, and its owners.

6.1 Employment Programs

A common adage is that a company's most important resource is its people. So it is at Manitoba Hydro, one of the larger employers in the province.

The recruitment, training and motivation of staff to meet future needs is and will be a continuing challenge.

Employment programs will be designed to assure an adequate number of qualified staff, while meeting objectives in respect to employee satisfaction, increasing productivity, and employment equity.

6.1.1 Staff Requirements

Figure 6.1 shows staff levels in each of the four major occupational groupings for the past five years, together with a projection for the next ten. The overall mix of personnel is not expected to change over the period of review.

Figure 6.2 shows whether these staff are working on current operations, engaged in the ongoing small to medium capital improvements to the system, or on the major projects such as Limestone and Conawapa.

There is basic growth of about 20 positions per year in the current operations component, as the total number of customers increases and an increased volume of energy is supplied. This growth is added to by about 30 positions whenever a major new hydro generating plant or HVDC station is commissioned, or 75 positions for a thermal generating plant.

The number of positions associated with the major projects will increase or decrease according to the schedule of the project, while the positions associated with the lesser capital projects are expected to stay relatively constant throughout the next decade. Work included in the latter category includes distribution line extensions and upgrades, small transmission line additions, new and extended switching stations, and major maintenance and rehabilitation work at the various generating and converter stations.

It is estimated that over the next 10 years, excluding term positions on the major projects, approximately

300 new positions will be created.

Hiring will also be required because of retirements and terminations. Based on current trends, 700 existing staff (or about 15%) will retire in the next decade, and while most employees make a career with Manitoba Hydro, about another 100 leave each year for other opportunities.

The net result will be an average requirement for new staff at the rate of about 200 people per year.

The vast majority of these will be recruited into what are known as input level positions—technician and lineman trainees, junior engineers, system analysts and so on. Manitoba high schools, training agencies, community colleges, and universities will provide most of the candidates. Manitoba Hydro staff are currently and will continue to be involved with the curriculum committees of various institutions to help ensure that graduates have the basic skills required in a modern, technologically intensive workplace.

6.1.2 Career Development

Manitoba Hydro generally practices promotion from within for job categories both included in and excluded from the various Collective Agreements.

In order to assist employees to equip themselves for these promotional opportunities, the Corporation offers development programs that have successfully provided most of the skilled journeymen, technicians, tradespeople, supervisors and managers needed to meet Corporate needs. Historically, 93% of all vacant positions available have been filled internally.

Future plans are to meet 96% of trades/technical skill needs through in-house training programs and to fill the large majority of all promotional opportunities with internal candidates. There are approximately 350-400 promotional opportunities annually.

The Corporation will continue to provide training and both personal and professional development oppor-

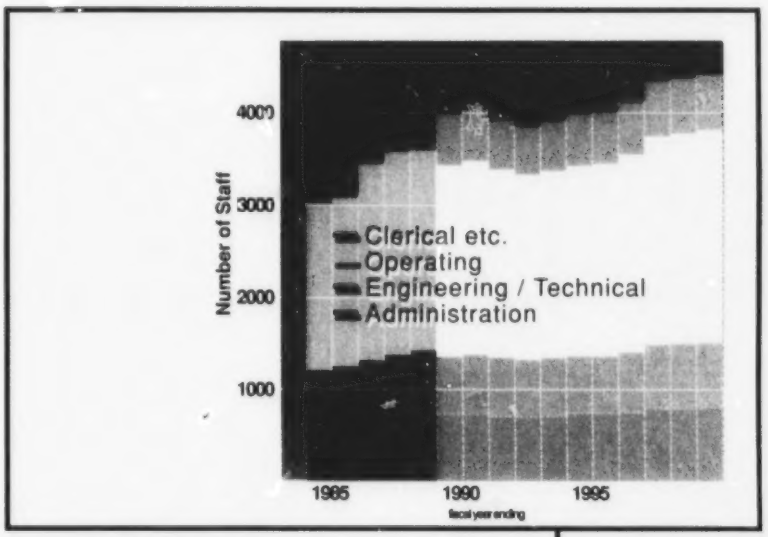


figure 6.1 ***Staff Levels***

figure 6.2 ***Staff Assignments***

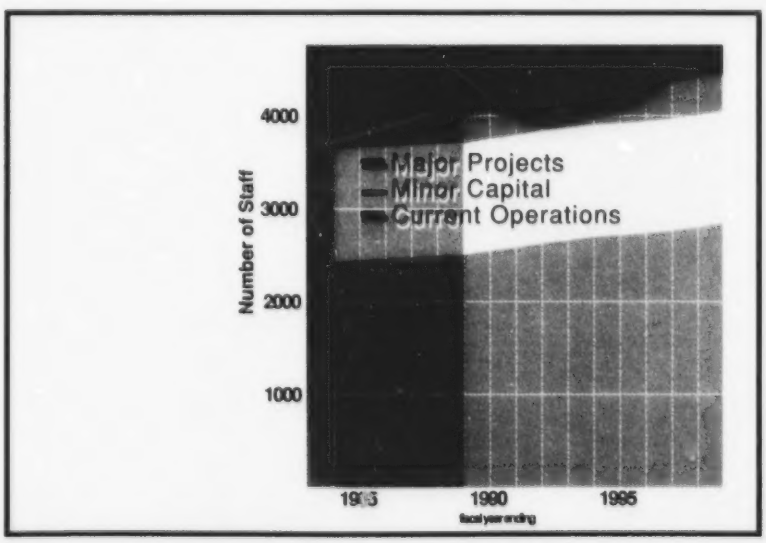
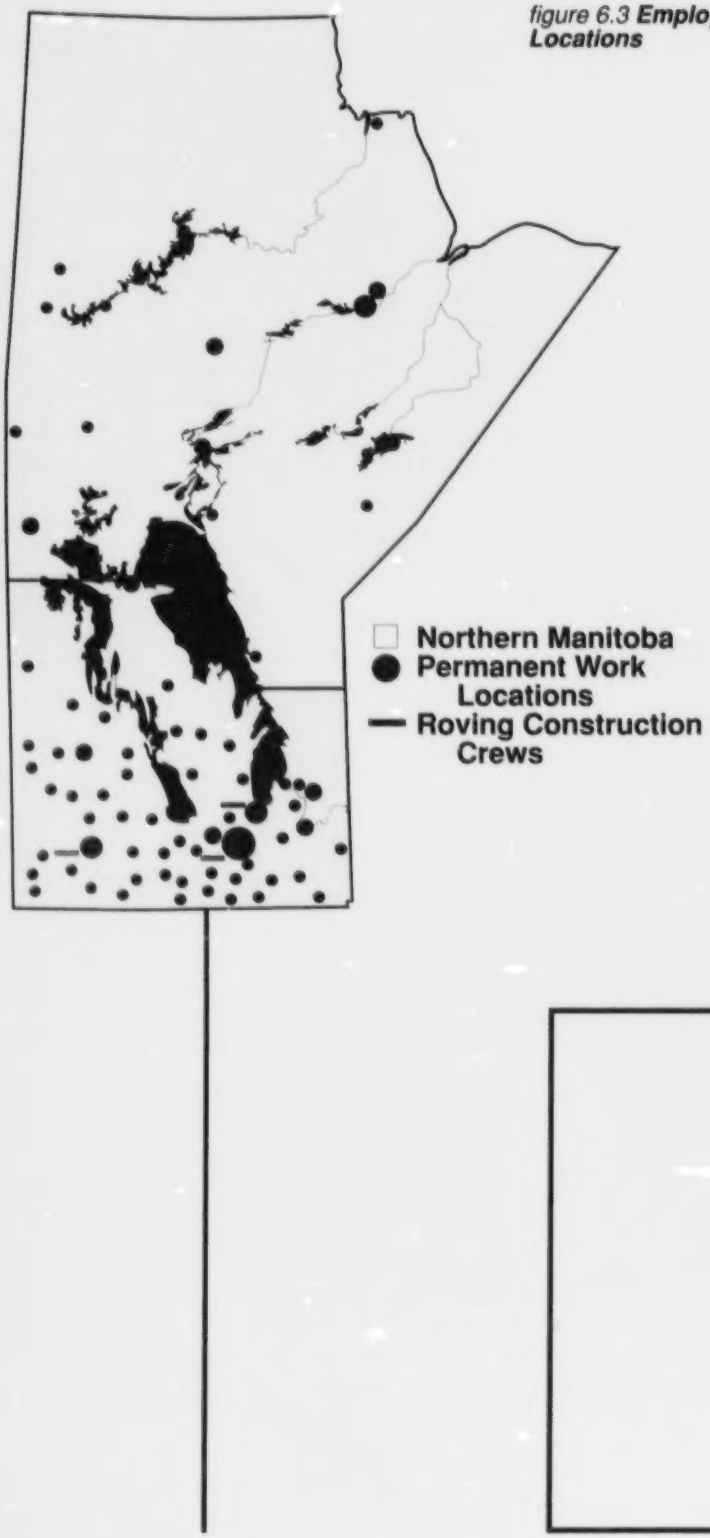


figure 6.3 ***Employee Locations***



tunities for employees through the over 80 courses offered in-house and through the various institutions offering such services. Training and development programs are reviewed from time to time to ensure that they continue to reflect the needs of both the Corporation and its employees.

6.1.3 Employee Locations

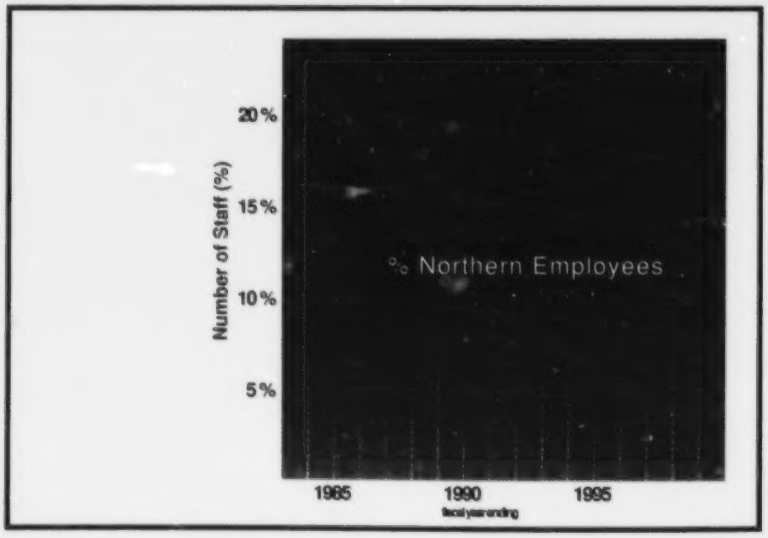
Manitoba Hydro assigns its employees to work at the locations where they will be most effective, that is, where there will be the optimum combination of customer service and efficiency. As a result, the Corporation's operations are extensively distributed throughout the province. Currently, approximately 49 per cent of employees, compared to 44 per cent of the province's population, live and work outside the greater Winnipeg area. The actual distribution of these work sites is shown in figure 6.3.

The distribution of work and employees changes from time to time as circumstances warrant. Occasionally, existing offices or work sites are closed and new ones are opened.

Recent years have seen a steady shift of work from the Head Office location to other areas. This is expected to continue as the Corporation makes more extensive use of the communications technology that is becoming available.

Manitoba Hydro will continue to re-assign jobs as required to improve customer service and the efficiency of corporate operations. It is also investigating potential opportunities for further relocation of jobs and activities in keeping with the Provincial government's broader objectives of rural development. All employee moves are undertaken in the context of the applicable Collective Agreement and/or a relocation policy which attempts to be fair to all involved.

figure 6.4 ***Percentage of Staff Working in the North***



6.1.4 Northern Staffing

Some 16% of Manitoba Hydro's employees currently live and work in northern Manitoba. This percentage has slowly increased with time, and is expected to increase further as additional generation and transmission facilities are constructed in the north. This is illustrated in Figure 6.4.

For Manitoba Hydro's staffing purposes, northern Manitoba is defined as that part of the province north of the 53rd parallel, shown in Figure 6.3, and includes Berens River.

The Corporation has always experienced difficulty in attracting experienced and qualified employees to apply for vacant positions in the north, and in the past has used several different techniques to fill these positions. Techniques include special incentives and benefits, compulsory assignment for definite and indefinite periods of time, fly-in operations, rotational assignments, and other approaches.

It is anticipated that these and other perhaps more innovative programs will continue to be required to operate the increasingly complex northern plant. While there is a growing number of people who prefer to live and work in the north, including people who have been born and raised there, and every effort will be made to recruit from among this group, they are not expected to satisfy more than a small portion of Manitoba Hydro's requirements in the foreseeable future.

A significant part of the Corporation's efforts will continue to be directed to assisting northern communities to provide an environment that will assure that staff and their families can lead complete and fulfilling lives, both on and off the job. These efforts will favour directions which encourage communities to become responsible for their own destiny.

6.1.5 Staff Productivity

One of Manitoba Hydro's corporate objectives is to improve productivity in all aspects of its business. Insofar as productivity can be defined as the relationship between product and all resources employed—capital, equipment, materials, natural resources, staff, and so on—it can be misleading to single out one of these resources. However, staff productivity is one area that can be looked at with a reasonable degree of independence.

Figure 6.5 shows the ratio of the energy (delivered in Manitoba by Manitoba Hydro) to the average employment level each year (for staff working on current operations). This illustrates the steady growth in productivity experienced over the last five years. It is expected that this growth will continue.

Productivity gains are expected to be made through many small steps, rather than through several large ones. Improvements are expected to range from increased mechanization, to re-organization, to simply doing the same thing better. Manitoba Hydro managers, at all levels, are evaluated in part on how they contribute to increased productivity.

6.1.6 Employment Equity

Manitoba Hydro has taken steps to assure that four target groups in the provincial labor force (i.e. women, aboriginal peoples, persons with physical disabilities, and persons who are, because of their racial origin, in a visible minority) are provided with opportunities for employment.

Special measures to date have concentrated on ensuring that target group candidates are qualified to compete. Programs have included bursaries in Engineering and Computer Science, special training initiatives, and technical aids/adaptive equipment. Structural alterations have been provided as required to assure physical accessibility to buildings and offices. These measures will be continued.

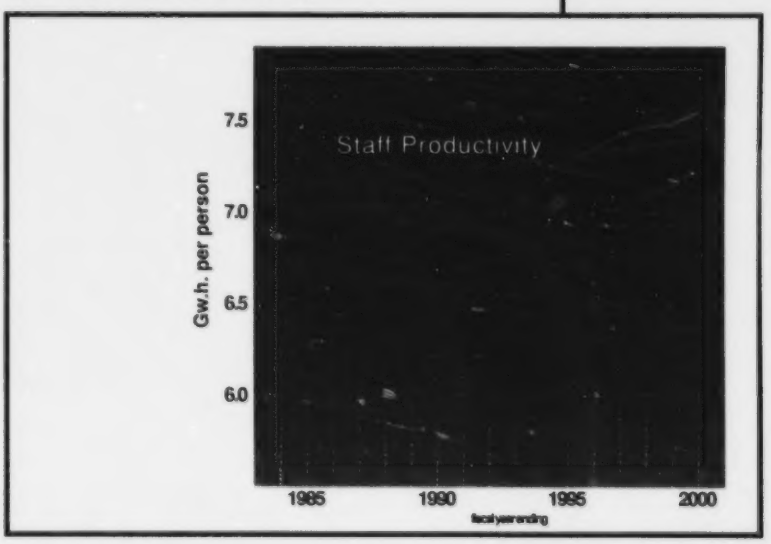
Representation of women has continued to increase in administrative and engineering positions; aboriginal peoples have increased their participation rates in administrative and clerical positions, but more significantly in the operating and construction areas.

The representation of target groups will continue to increase through aggressive recruitment and through the removal of internal systemic employment barriers. Progress will vary based on Manitoba Hydro's need and the target group member availability.

6.1.7 Labor Relations

Approximately 85% of Manitoba Hydro employees are represented by three different bargaining units: the International Brotherhood of Electrical Workers (IBEW Local 2034) represents about 2 300 employees, mainly in the operating and construction areas; the Canadian Union of Public Employees (CUPE Local 998) represents about 850 clerical and technical work-

figure 6.5 ***Staff Productivity***



ers, mostly in Head Office; and the Association of Manitoba Hydro Staff and Supervisory Employees, (AMHSSE) represents about 375 senior staff employees and first and second line supervisors.

In addition, there is the Manitoba Hydro Professional Engineers Association, a voluntary, non-registered association representing the interests of the 230 Professional Engineers employed by the Corporation.

The current three-year collective agreements with CUPE, AMHSSE and the IBEW expire in the period from December 1990 to May 1991. Based on historical success, it is anticipated that two-year or three-year renewal agreements will be negotiated at that time.

Dialogue and consultation between the Corporation and the bargaining units through various forums will continue and be encouraged in an attempt to resolve issues as they arise. Grievances are expected to be resolved at the lowest possible corporate level. There is a continuing need to provide labor relations training to management and supervisory staff in order to achieve this objective.

Manitoba Hydro believes that customer service and productivity are both best improved through enthusiastic committed employees, and intends to maintain an environment where this is achieved.

6.1.8 Employee Safety

Many Manitoba Hydro employees must work under hazardous conditions. There are employees who routinely work in the proximity of high voltage lines. There are employees who must work outdoors in every kind of weather. There are employees who must drive thousands of kilometers each year, often under difficult road conditions, in the performance of their tasks.

Manitoba Hydro is deeply committed to instilling a safe work attitude in its employees. Safety training is rigorous and continuous. The Corporation makes every effort to minimize potential hazards and provide safe work environments for all employees.

The Corporation has a good safety record, which it intends to maintain. A continued aggressive safety and occupational health program is expected to maintain Manitoba Hydro's lost-time injury frequency rate at among the best three of the fourteen major electrical utilities in Canada.

The Corporation's active safety program has two benefits. The first (and foremost) is a reduced number of injured employees. The second (not insignificant either) is that Annual Workers Compensation Board assessments are about $0.50 per $100 of payroll, compared to the Manitoba average of approximately $2.35. This represented a direct saving of over $2.5 million in 1988/89 alone.

The same applies to safe driving programs. By keeping the cost of vehicle accidents at less than 50% of the insurance premiums paid, Manitoba Hydro qualifies for the maximum 25% refund on these premiums which is available to fleet operators. The Corporation intends to earn these refunds, while at the same time minimizing the personal injury and stress and the disruption to work activities associated with traffic accidents.

6.2 Impact on the Economy

Manitoba Hydro, through its construction and operating expenditures, plays a significant role in the Manitoba economy.

Aside from the direct purchasing power of the Corporation and the indirect purchasing power of its employees and suppliers, the Manitoba economy also benefits from electricity rates which are among the lowest in North America. Manitoba Hydro's reliable and relatively inexpensive hydro resource provides Manitoba businesses with a competitive advantage, particularly where electricity costs comprise a large proportion of total costs.

6.2.1 Business Placed with Manitoba Companies

The cornerstone of Manitoba Hydro's purchasing policy is the open, competitive bidding process. Generally, the lowest-cost technically acceptable bid will be recommended for purchase. However, to enhance local, northern, and northern native supplier involvement in Manitoba Hydro work, other criteria are occasionally used. These are:

a) Buy Manitoba Program:

The Buy Manitoba Program, a government program in support of Manitoba manufacturers, has been in place since 1983. The program permits the Corporation to pay, at its discretion, a marginal premium to award business to Manitoba manufacturers. The program was expanded in 1985 to include all northern assemblers, warehousers, and distributors as well as manufacturers when competing for northern business with out-of-province companies.

The Corporation is currently discussing with the other public utilities in Western Canada the possibility of reducing such preferential purchasing policies in respect of suppliers in the four Western provinces.

b) Northern Purchasing Guidelines:

Special northern purchasing guidelines were adopted by Manitoba Hydro in 1985. They are designed to assist in meeting the Corporation's objectives of increasing northern and native participation in business opportunities arising from major hydro development projects, as well as other northern projects. The guidelines were adopted and are applied on the basis that Hydro would not incur any significant costs associated with any preferential business program.

More important than any possible premiums, are the efforts of both Manitoba Hydro and various Provincial Government Departments to assure that Manitoba suppliers and contractors are in a good position to bid for the work. The efforts include a variety of initiatives—trade directories, advertising, information exchanges, contract repackaging, and so on.

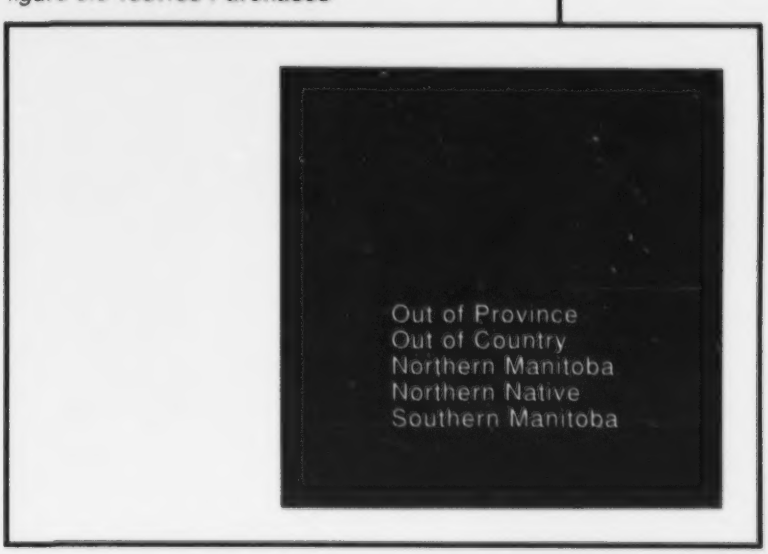
It has been found that these initiatives particularly assist small and native business to compete for and win contracts simply on the basis of price and quality.

Purchasing statistics for the fiscal year, April 1, 1987 to March 31, 1988, indicate that of total Manitoba Hydro purchases valued at $268.5 million, $187.7 million or 70% was for goods manufactured in Manitoba or for services performed in Manitoba. See Figure 6.6.

6.2.2 Financial Impact

On an ongoing basis Manitoba Hydro employs some 4 000 persons. During periods of construction of new generation facilities, other employment opportuni-

figure 6.6 ***1987/88 Purchases***



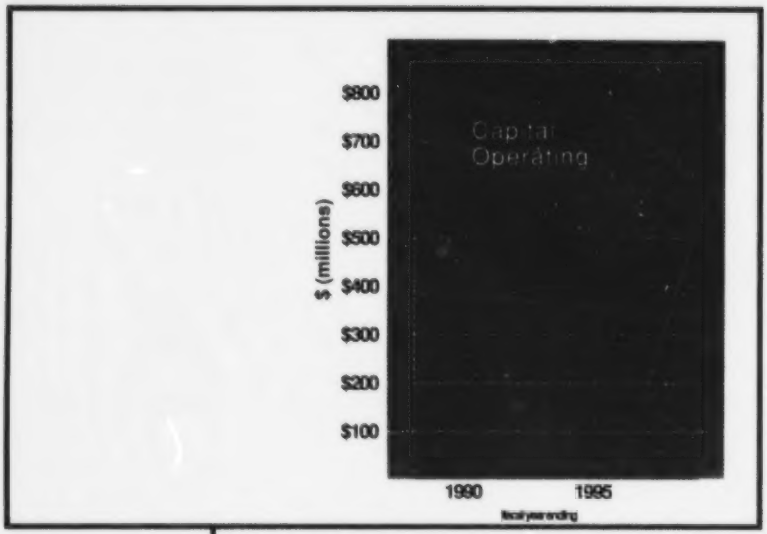


figure 6.7 ***Purchase of Goods and Services***

ties arise. For instance, the $1.52 billion Limestone Generating Station which is currently under construction, is providing some 5 000 person years of direct employment. Spin off employment from both ongoing employment and periodic construction employment results in an additional contribution to the provincial economy.

Manitoba Hydro currently spends about $500 million per year for goods and services, including wages and salaries, for its operating and construction programs. This will fluctuate in step with the capital program, but, as shown in Figure 6.7, over the next 10 years it is expected to average about $600 million (in constant 1988 dollars). Assuming that current experiences can be sustained, between $340 million and $600 million (again in constant 1988 dollars) will continue to be injected annually into the Manitoba economy.

The term 'constant 1988 dollars' means the value in 1988. With inflation, the value of the dollar decreases, or alternatively it takes more dollars to purchase the same goods and services. Therefore the actual expenditure on goods and services will probably be in the order of $1 billion per year, depending upon the rate of inflation.

It has been estimated that Hydro's operations contribute between 5% and 10% of the Gross Provincial Product.

6.2.3 Northern Construction Projects

Contracts for construction work awarded by Manitoba Hydro have a significant impact on the demand for construction workers in Manitoba, particularly in northern Manitoba. This demand during peak periods of a major project such as Limestone would require up to 10% of all Manitoba construction workers and up to 50% of certain tradesmen such as carpenters and ironworkers. A project the size of Limestone obviously requires an inflow of some out-of-province workers.

It is anticipated that, during the next 10 years employment levels on northern contracted construction work will range from 200 to 2 000 persons and will average 400 to 500.

Historically, contracts for major northern hydroelectric and converter stations have included a project collective agreement with a no strike/no lockout provision for the duration of the project. This feature eliminates the risk of a work stoppage that would cause an in-service date delay and associated problems.

Provisions are included in all contracts to give employment preference to qualified residents of northern Manitoba. In addition, since 1985, a special measure for qualified northern natives has provided them with preference over other northerners. This provision is considered appropriate in view of the proximity of some northern native communities to Manitoba Hydro's major northern facilities, and the high unemployment rates within these communities.

During construction of Limestone, northern native participation rates have ranged from 18% to 30% of the total work force while northern resident participation rates have ranged from 30% to 60%.

Both levels of government have funded pre-employment and on-the-job training for the Limestone project to assist and complement the contractors' efforts to obtain qualified workers from within Manitoba. Since 1985, contract provisions have also required contractors to employ apprentices. This thrust is intended to increase the supply of skilled tradespersons while at the same time facilitating the training of northern natives.

It is anticipated that the construction of future major stations and additions thereto will continue to be covered by a project collective agreement.

It is also anticipated that northern and northern native preference clauses will continue to be a part of these collective agreements, or will otherwise be applied where a contract is not covered by an agreement.

It is further anticipated that both the Provincial and Federal Governments will continue to participate in the recruitment and training of the necessary workers.

6.3 Impact on Native Communities

Much of Manitoba Hydro's work, particularly in northern Manitoba, brings it into contact with the native residents of the area.

Managing these interfaces in a way that reflects the interests and rights of the native residents, without adversely affecting the Corporation's other customers and owners, presents a continuing challenge to the Corporation.

6.3.1 Background

Manitoba Hydro is primarily a hydraulic power generation system, where system development and operation results in modifications to the natural water levels and flows in northern waterways. Such modifications can cause adverse effects to the people who live in the area. Native people have certain aboriginal rights pertaining to these waterways. Also, some Treaty Indians adversely affected by Hydro's regulation of water regimes have obtained contractual rights through the Northern Flood Agreement.

In order to prevent or minimize adverse effects associated with corporate developments, steps are taken to ensure close coordination with public services and programs provided on Indian reserves by the Federal Government. Manitoba Hydro makes compensation for unavoidable adverse effects caused by its actions.

6.3.2 Northern Flood Agreement

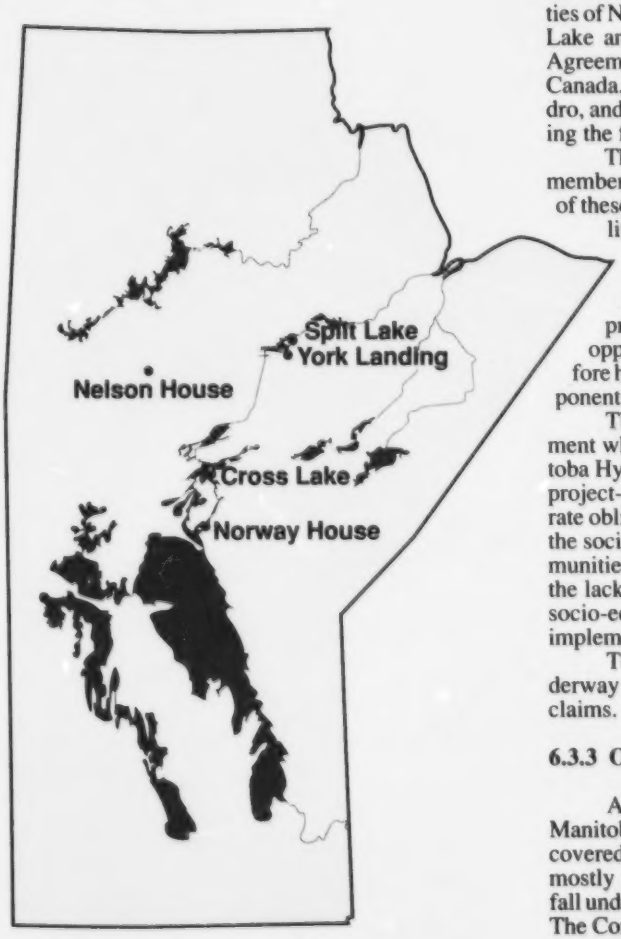
The Northern Flood Agreement provides a framework for settlement of disputes relating to the adverse effects of the Lake Winnipeg Regulation and Churchill River Diversion projects on the five Indian communities of Nelson House, Cross Lake, Norway House, Split Lake and York Landing. See Figure 6.8. This 1977 Agreement has four signatories—the Government of Canada, the Government of Manitoba, Manitoba Hydro, and the Northern Flood Committee Inc. representing the five Indian communities.

The Agreement's objective is to compensate members of the five Indian Bands for the adverse effects of these projects on their lands, pursuits, activities and lifestyles. However, at the same time, it is intended that such compensation be supplemented by and coordinated with government-funded development initiatives directed at improving the living conditions and employment opportunities for the Bands. The Agreement therefore has both compensatory and developmental components.

There is some lack of specificity in the Agreement which can lead to varying interpretations. Manitoba Hydro considers that its obligations are limited to project-induced adverse effects. Others see the Corporate obligation in the broader context of contributing to the socio-economic advancement of these native communities. These differing perspectives, coupled with the lack of baseline, or pre-project environmental and socio-economic information, lead to difficulties in implementation.

To accelerate progress, efforts are currently underway to negotiate a 'global' settlement of outstanding claims.

figure 6.8 ***Northern Flood Committee Communities***



6.3.3 Other Native Communities

Among the Native communities affected by Manitoba Hydro's projects there are a number not covered by the Northern Flood Agreement. These are mostly non-Treaty Indian communities that generally fall under the jurisdiction of the provincial government. The Corporation is committed to treat these communi-

ties fairly and reasonably in resolving their claims for adverse effects.

6.3.4 Future Developments

Future development in northern Manitoba will inevitably lead to further interaction with various native groups.

Manitoba Hydro will ensure that pre-project conditions and directions of change are clearly defined. It will predict and identify project-induced changes, and it will attempt to mitigate these wherever feasible. It will compensate fairly where mitigation is not feasible.

Manitoba Hydro will work with the affected parties to the extent practical, and within the limits of sound business practice, to ensure that native groups and individuals have the opportunity to build economic development activities around the Corporation's operations.

6.4 Export Services

Canada has some of the most advanced electrical systems in the world. As a result, many countries in what is known as the Third World, seeking to improve their own systems, have turned to Canada for assistance.

Manitoba Hydro is able to respond to some of these requests with staff that can provide consulting services in the management and operation of electrical power systems. It is not usually able to respond to requests for design and construction assistance.

Opportunities for supplying consulting utility services are generally researched by funding agencies such as the World Bank, Asian Bank, and the Canadian International Development Agency (CIDA). Out of the vast market researched, Manitoba Hydro has responded to opportunities in Egypt, China, Zimbabwe, Kenya, Ethiopia, India, Brazil, Jamaica and Honduras, most of which are CIDA funded.

The consulting services represent a very small proportion of the Corporation's activities, and for the most part can be accommodated by existing staff. Longer term overseas assignments require replacement of staff.

Throughout 1989, 1990 and 1991, Manitoba Hydro may have up to eight staff members full time overseas. Figure 6.9 shows the country and duration of both committed and proposed assignments.

There are no commitments beyond 1992, but, since this level of commitment appears to be sustainable, it is anticipated that further, equivalent opportunities will be pursued.

Most of the services supplied to date have been in conjunction with Canadian consulting engineering firms. The services have been in the two categories of engineering support services and staff-training services. Because funding agencies are allocating a larger portion of their funds to "Human Development", increased interest is being directed towards staff training of electric utility personnel. Consequently, the majority of future work is expected to consist of this sort of training.

The Corporation is also willing and able to assist in international relief efforts such as was required in Jamaica after Hurricane Gilbert.

Manitoba Hydro has several reasons for being in this business:

–To help Manitoba consulting companies gain access to markets they might otherwise have difficulty in breaking into.

–To promote Canadian and Manitoba expertise.

–To help fulfill Canada's commitment to assist developing countries.

–To provide additional career opportunities for employees.

Export Services are provided on the basis that there will not be a net cost to the Corporation. Figure 6.10 shows anticipated gross revenues and net profits for the period 1987 to 1991.

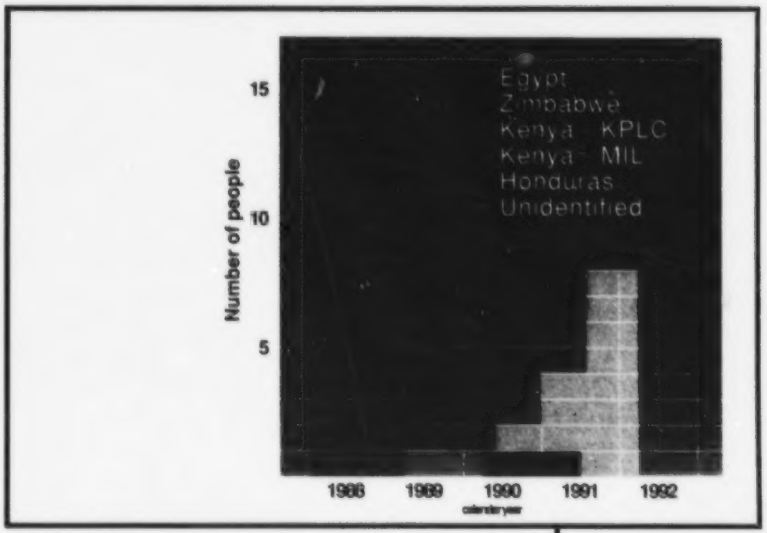
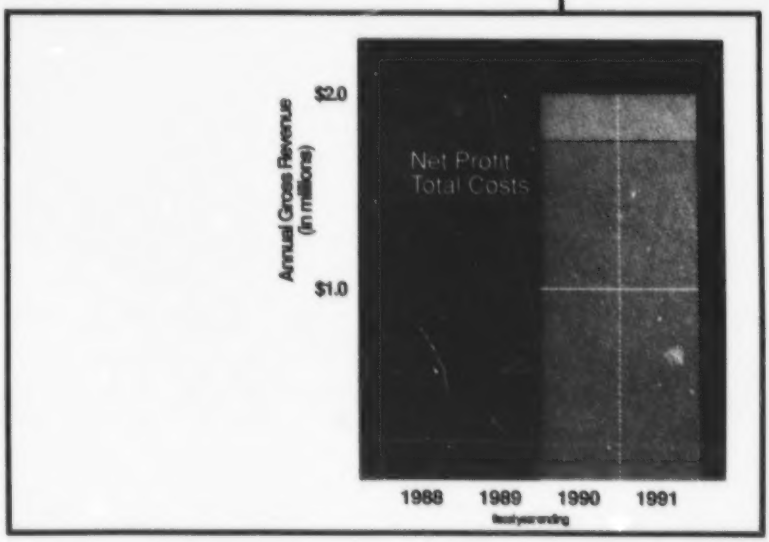


figure 6.9 ***Overseas Commitments***

figure 6.10 ***Revenues from Consulting Services***



6.5 Research and Development

Effective research and development across a wide range of technologies is one of the keys to both economic and social development in Canada. Manitoba Hydro enthusiastically accepts a measure of responsibility and has established a research and development program designed to encourage innovation in all areas that its business activities touch or are touched by.

6.5.1 Scope and Areas of Interest

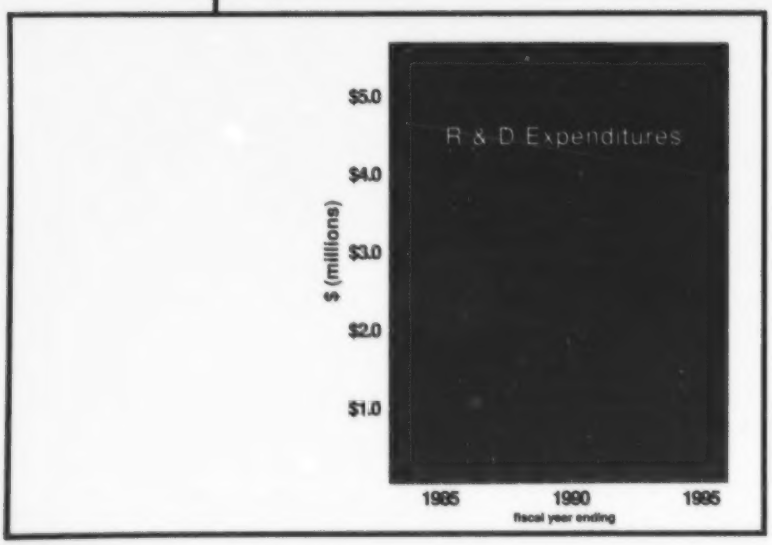
As an organization which relies heavily on a wide range of technologies, Manitoba Hydro's research and development activities will cover this entire range. Projects varying from research into environmental rehabilitation in reservoirs to sophisticated metering techniques will enable the Corporation both to take advantage of emerging technologies and to make better use of existing ones. This will contribute to lower rates, and better system reliability, and will result in projects that have less adverse environmental consequences.

Research and development is also conducted in technologies that will assist customers to use energy more efficiently and effectively.

Manitoba Hydro has a particular interest in high-voltage direct current transmission, and therefore supports the Manitoba HVDC Research Centre. This will continue into the 1990's. The Centre is a world leader in high-voltage direct current research and, while developing and improving technology for Manitoba, the Centre will market its expertise worldwide.

Similarly, Manitoba Hydro has arranged for a local manufacturer to complete the development for the Corporation of specialized electronic equipment which has the potential to improve the Corporation's service reliability. This equipment might also be sold to other power utilities throughout North America in the next decade, under manufacturing and marketing arrangements that provide significant advantages to Manitoba businesses.

figure 6.11 ***Research and Development Expenditures***



Manitoba Hydro's program is administered to provide a balance between the commitment needed to properly pursue a relevant area of interest, and the flexibility required to investigate the new areas that abound in a world of exponential growth in technological capability.

Current and projected research and development expenditures are shown in Figure 6.11.

6.5.2 Collaborators

Historic successes have taught the Corporation that, in the field of research and development, two or more heads are invariably better than one. The synergy created, when people of different experiences, skills and backgrounds work cooperatively to solve a problem or examine an opportunity, has proven to be infinitely more valuable to Manitoba Hydro than "going it alone". Consequently the Corporation encourages outsiders to collaborate with staff, and vice versa, to the greatest possible extent.

Manitoba's universities are a tremendous source of expertise that Manitoba Hydro can utilize into the future. Faculty and students, primarily at the post-graduate level, will work on diverse projects that will assist the Corporation. For example, new formulas will be developed to optimize use of water resources, and several students every year write Masters or Doctors theses on Hydro-initiated topics.

Nationally, Manitoba Hydro participation in the Canadian Electrical Association (CEA) Research and Development Program is a key to joint development of innovative ideas within the power industry throughout Canada. This partnership will play an important role in the future development of technology at Manitoba Hydro. The Corporation's annual $250 000 investment in CEA Research and Development is leveraged at least 30 times by the contributions of all other parties in this consortium.

Manitoba Hydro also plans on utilizing the many expert consultants available in the province to assist in overall research and development for the Corporation. Several projects underway now will have an impact on industry in the next ten years.

6.5.3 Emerging Technological Issues

Part of Manitoba Hydro's program is to assess emerging technologies which appear to have potential for major impacts on the business environment. An interesting aspect of modern Western society is that technological developments or issues are quickly and widely disseminated, sometimes with exaggerated expectations as to their likely effect. Manitoba Hydro's concern is not to over-react to premature hopes or fears, but to ensure that it is in a position to respond effectively to the discoveries that do turn out to be valid.

This watching brief will be continued, with subjects being added or deleted as necessary. Two obvious topics of current interest are high temperature super-conductivity and electromagnetic field effects, but there is a host of others.

In the case of the two examples noted, superconductors may have a major impact on the Corporation because they offer little resistance to current flow. Near zero resistance would create opportunities throughout the whole spectrum of generation, transmission, storage, distribution and utilization of electricity. However these impacts are thought to be a least ten to fifteen years into the future, and then, will be readily and incrementally assimilated into the existing systems.

On the other hand, while a number of studies are underway to examine the potential health effects of electric and magnetic fields, the expectation is that there will be no identified effects and very little impact on the design of the power lines of the future. The Corporation will, however, take into consideration public concerns over the issue in the way it selects the locations of these lines.

6.6 Public Safety

When used properly, electricity is a safe and valued energy source. It has the potential, however, to be lethal. Manitoba Hydro assumes, as part of its mandate, a responsibility to educate people on these dangers and how to avoid them.

6.6.1 Education and Promotion

A significant effort is expended in classroom education, particularly at elementary schools. Safety habits acquired young are probably the most enduring.

The K-6 program educates students from Kindergarten to Grade 6 about electricity, thus developing positive attitudes towards electricity and its safe use.

The poster program provides a series of messages dealing with the efficient and safe use of electricity. The messages are aimed at students at all levels in the educational system.

Other programs, which are aimed at all Manitobans include:

SAFETY ADVERTISING: Safety advertising educates and informs on some of the situations that contain hazards due to electricity. A spring and fall radio and television advertising campaign is undertaken with Winnipeg and Brandon TV stations which have donated additional free air time.

SAFETY AWARD: The program acknowledges an outstanding contribution by a member of the media in assisting the Corporation in the promotion of electrical safety. The first such award was made in 1988.

YOUTH SAFETY PROGRAM: The program introduces students to some basic concepts about electricity in order to develop an awareness of, and respect for, the potential dangers of electricity if misused.

FARM SAFETY DISPLAY: The hazards related to overhead lines are graphically brought to the attention of farm customers. Farm auger displays are presented at major agricultural summer fairs.

These and similar programs will be continued indefinitely.

6.6.2 Electrical Inspection

All buildings in Manitoba must be constructed in accordance with the appropriate electrical code. Manitoba Hydro plays an active role in the development of these codes, and outside the City of Winnipeg is responsible for the inspection of all installations and for the issuance of permits.

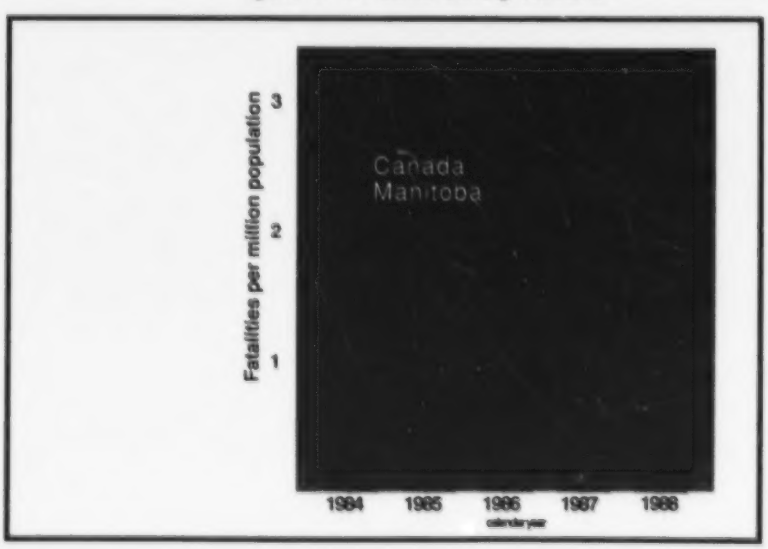
This program assures that all electrical installations meet the minimum requirements for safe operation.

6.6.3 Safety Record

With respect to electrical accidents, the public safety record in Manitoba is very good. In terms of fatalities as a percentage of population, Manitoba has been consistently at or below the national average. See figure 6.12.

Manitoba Hydro regards any public accident involving electricity as a failure of the safety programs. The Corporation will continue to strive to eliminate accidents altogether.

figure 6.12 ***Public Safety Record***



6.7 Public Affairs

All Manitobans have a stake in both the day-to-day fortunes and the long-term future of Manitoba Hydro. Communicating the activities, plans and goals of Manitoba Hydro to its stakeholders is an ongoing responsibility of the organization.

6.7.1 Communications - The Public Connection

Manitoba Hydro communicates with the public in a variety of ways.

A number of the publications are issued including: the Corporation's Annual Report; monthly informational bill inserts; information pamphlets on corporate facilities and history; information about the safe and efficient use of electricity; news releases; and educational material about various aspects of the electrical industry.

In addition to printed material, Manitoba Hydro maintains a library of films that are available free of charge for viewing by interested groups.

A Speakers' Bureau provides employee volunteers to address groups on a variety of subjects related to the Corporation's activities.

6.7.2 Participation in the Community

Manitoba Hydro participates in a number of community activities. Each year floats and displays are made available to fairs and industry exhibitions in communities around the province. Tours of Corporation facilities are arranged for school children and other groups each year. The Corporation also encourages employees to be active in professional and community activities.

Manitoba Hydro works with government and industry to promote the efficient use of energy and participates in joint programs, such as the CHEC Loan Program and Home CHEC-UP, to actively encourage consumers to reduce their consumption of electricity through such features as improved insulation.

6.7.3 Public Accountability

In addition to its legislated reporting arrangements to the Manitoba Legislative Assembly, through the Board and Minister, the Corporation has other forums in which its activities, rates and plans can be examined by the public.

Annually, representatives of Manitoba Hydro appear before the Standing Committee on Public Utilities and Natural Resources, a committee of all parties in the Legislature, to review the Annual Report of the Corporation and to discuss current activities.

Any changes to the rates charged by Manitoba Hydro are subject to the approval of the Public Utilities Board, and that Board may hold public hearings to review the proposed rates.

Also, Manitoba Hydro has committed to request the Public Utilities Board to review its major capital plans, and it is anticipated that PUB will in turn hold public hearings to facilitate that review.

When the Corporation contracts to sell power outside of Canada, it must obtain a licence or a permit from the National Energy Board who may also hold public hearings to examine the application.

Prior to the commencement of construction of any major facility, the Corporation must obtain a license under the Manitoba Environment Act. Towards this end, the Clean Environment Commission is expected to hold public hearings in respect of these facilities.

Under the Crown Corporations Public Review and Accountability and Consequential Amendments Act, Manitoba Hydro is required to hold public meetings at least three time a year to allow the public to comment on the Corporation's policies and practices. The Manitoba Hydro-Electric Board also holds some of its regular meetings in different areas of the province to provide Board members with a regional perspective.

It is important that all Manitobans have the opportunity to understand and influence Corporate plans and initiatives, and Manitoba Hydro will continue to try to facilitate this opportunity.

Maintaining the Corporation's fiscal viability while at the same time minimizing the cost of electricity to its customers is a continuing concern to Manitoba Hydro.

There are many issues involved in the subject of financial management. These include the inter-related areas of rates, reserves, risks inherent in the Corporation's operations, and the financing of capital programs.

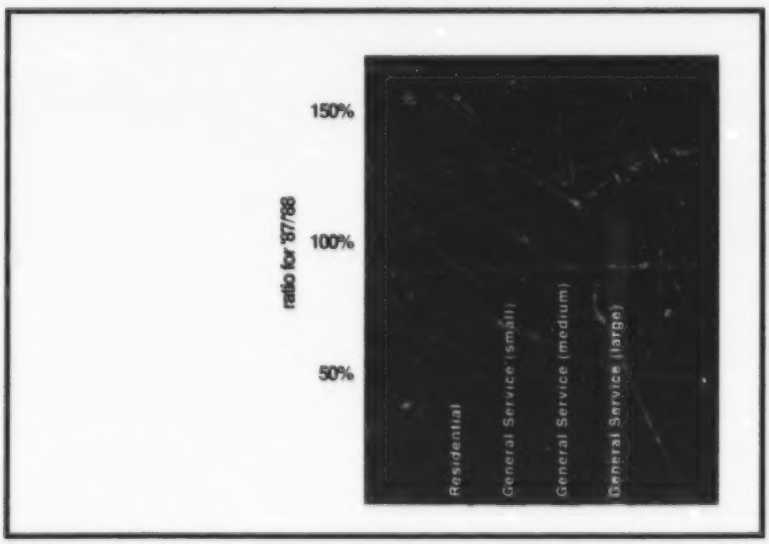
7.1 Domestic Energy Rates

The rates to be charged to Manitoba customers are designed to meet the revenue requirement of the Corporation over the ensuing period. The overall level of the rates is established by The Manitoba Hydro-Electric Board following review of the Integrated Financial Forecast (IFF). The amount of the increase is determined by comparing the revenues expected (at forecast levels of consumption at current rates) with the revenues required to meet forecast operating costs plus a contribution to the Reserves of the Corporation.

For rate setting purposes, customers are grouped into two classifications: residential and non-residential. Non-residential customers are subdivided into General Service Small, Medium and Large. Except for the General Service Large category, there is a further grouping of all customers into three rate zones.

All domestic energy rates are subject to final approval by the Public Utilities Board.

figure 7.1 ***Revenue/Cost Coverage Ratio***



7.1.1 Rate Setting Procedures

An annual review, known as the Cost of Service Study, calculates the cost of serving different classes of customers. Traditionally, this study has been based on actual results for the preceding year, but in future will be based on expected costs for the following year. The total annual costs of the Corporation are allocated to the customer rate classes in a number of ways:

1) by direct identification;

2) in proportion to their share of load on the system;

3) in proportion to the number of customers in each class.

The cost allocations are then compared to the revenue received from customers in each class; the comparisons are known as Revenue/Cost Coverage (RCC) ratios. These ratios indicate the degree to which the customer rate class/subclass contributes to its particular cost of service.

Revenue/Cost Coverage ratios as of March 31, 1988 are shown in Figure 7.1, and demonstrate that the residential sector does not fully pay its cost of service.

While the Cost of Service Study has the appearance of precision, it will not disclose with complete exactness the actual cost of serving a particular group of customers. It provides an approximation only.

In addition to the results of the Cost of Service Study, there are certain design guidelines which are used in preparing rate schedules. These are:

1. Projected revenue must be sufficient to cover all costs, including increases to reserves.

2. There will be a minimum number of rate classifications with each rate reflecting the practical attributes of simplicity, understandability, public acceptability, and feasibility of application.

3. The rate tariffs must recover part of the fixed costs in the minimum bill in order to provide revenue stability.

4. There must be fairness of rates through the equitable apportioning of total costs among all customers.

Every change in the rates is first subject to approval by the Board of Directors of Manitoba Hydro.

The Government of Manitoba recently passed The Crown Corporations Public Review and Accountability and Consequential Amendments Act. This Act provides for compulsory review and approval or disapproval by the Public Utilities Board of any change in Manitoba Hydro's rates or of the introduction of any new energy rates for Manitoba customers.

7.1.2 Rate Strategies

The term 'rate strategies' is industry jargon for the task of devising rate schedules that are both simple and fair. Ideally, rate schedules should be easy to understand, easy to apply, easy to administrate. Also ideally, rate schedules should guarantee that customers pay no more than a fair share of the targeted revenue.

These two ideals are not always completely compatible.

Rate strategies combine three elements: the first is the overall level of rates; the second is the relative contributions of different types of customers; and the third is the structure of the rates within each class.

To ensure fairness and equity between different customer class RCCs, Manitoba Hydro would like to achieve a long term target range with 90% as the lower boundary and 110% as the upper boundary. An 85% to 115% range is being used as an interim target, until certain improvements in the cost of service studies have been implemented. Rate adjustments to achieve the target ranges will be gradual.

The basic rate strategy is to reduce the number of rate schedules, eliminate end-use rates, simplify the rate structures, and refine the relationship of rates to costs.

Eventually a two-part tariff (that is, a basic charge and an energy charge) is being sought for the Residential Class and the General Service Small Class. This is in place of the current three-part tariff (basic charge, first energy block, tail energy block). This objective is being pursued on a gradual basis through increasing the charge on the tail block more than the charge on the first block.

End-use rates such as those for flat rate water heating and seasonal service are being eliminated through attrition (that is, no new services) or through blending them into standard rate zones.

As part of an ongoing review and evaluation of rate design and forms, certain alternative types of rates have been identified as being of potential interest to Manitoba Hydro. Possible interruptible rates are currently being reviewed. Developments in the area of "Marginal Cost Based Rates" (see glossary), "Time of Use Rates", "Postage Stamp Rates", and "Social Responsibility Rates" continue to be monitored. No specific proposals on any of these alternative rate forms are currently under consideration.

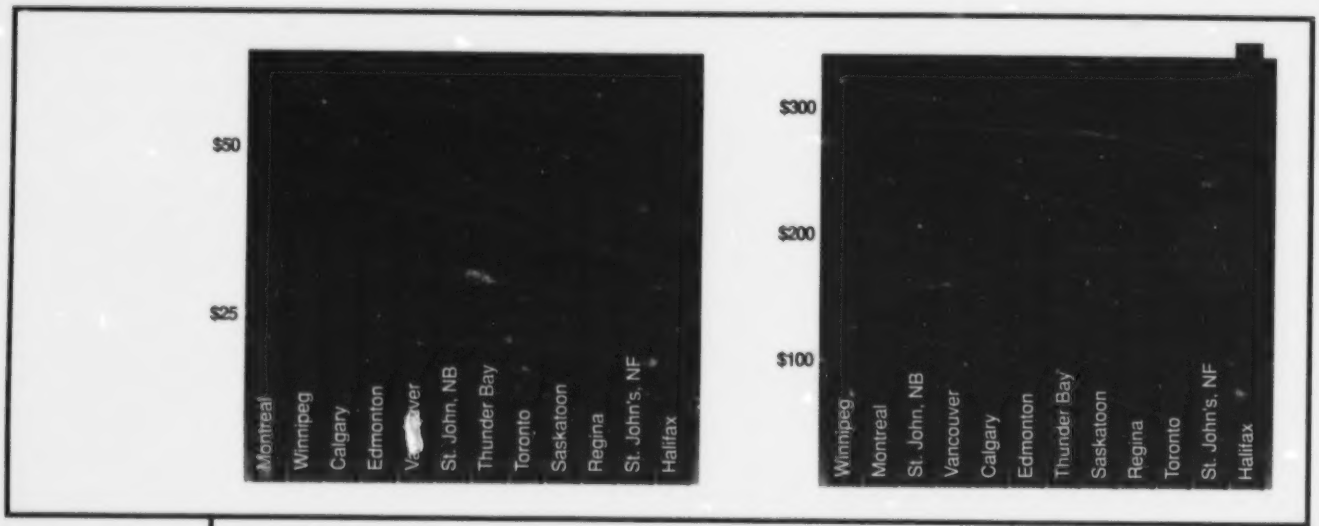


figure 7.2 ***Monthly Residential Bills*** *(750 kW.h/month and 5000 kW.h/month)*

7.1.3 Current Rates

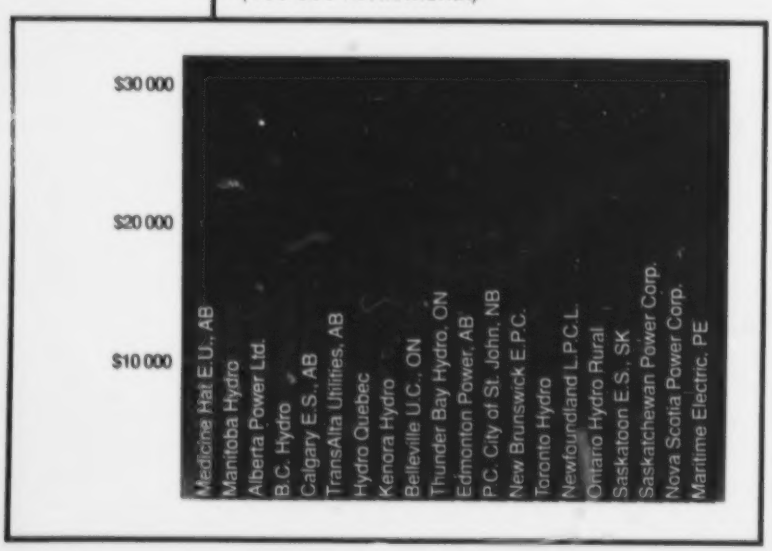
Manitoba Hydro's rates are currently among the lowest in Canada for most rate classes. Figure 7.2 show the relative level of monthly bills for residential customers in major Canadian cities as of May 1, 1989.

Similarly, Figure 7.3 shows the relative level for Canadian utility customers with a 1 000 kW service, also as of May 1, 1989.

The current Corporate plan of maintaining the inflation-corrected price of electricity at or below its current level, should permit Manitoba Hydro to maintain its relative position in the foreseeable future.

Manitoba Hydro has applied for an average rate increase of 4.5%, effective April 1, 1990. Inflation over the year ending then is expected to be approximately 5%.

figure 7.3 ***Monthly General Service Bills*** *(400 000 kW.h/month)*



7.2 Financial Reserves

Manitoba Hydro's financial reserves serve several important functions, one of which is to allow the Corporation to avoid sudden rate changes in response to various events. The Corporation's reserves do not consist of a fund of cash, although at any given time Manitoba Hydro may have cash equal to or in excess of its reserves. Manitoba Hydro's reserves are the equivalent of the owner's equity in a private business.

7.2.1 Need for Reserves

Equity is defined as the residual value after liabilities or claims are deducted from assets. As such it represents the ownership interest in the entity or business. Equity in Manitoba Hydro is contained in the Contingency and General Reserve and the Rate Stabilization Reserve. Manitoba Hydro does not issue shares, and reserves can only be increased when revenues exceed expenses. Conversely, when expenses exceed revenues, Corporate reserves will be reduced.

Reserves afford Manitoba Hydro and its customers several benefits. For example, they are used to absorb the cost and maintain financial stability during drought periods.

Manitoba Hydro also faces a variety of other risks including:

–Physical damage resulting from storms, floods, fires and other natural disasters.

–Loss of major customers/export markets through external events.

–Decline in economic activity within the province.

–Equipment failures.

–Damages to third parties not covered by insurance policies.

Reserves provide the Corporation with the ability to withstand the effects of these possible events. While the probability of certain events occurring may be very small, these risks are an inherent part of doing business and cannot be ignored.

Investor confidence as expressed through credit ratings, is closely tied to both the level of reserves, and the ability to increase reserves. Manitoba Hydro is a capital intensive utility and, as such, borrows heavily to maintain and construct facilities. In the extreme, if Corporate reserves were completely depleted, the credit rating could be lowered, resulting in higher interest rates. This would directly affect customers both in the short and long terms as these higher interest rates would have to be reflected in power rates.

Reserves also reduce interest costs on debt by providing a source of internally generated funds, and act as a "cushion" to the sharp increase in interest and depreciation costs which typically occurs when new major facilities are added to the generation and transmission system. The absorption of some of these costs through the use of reserves allows a gradual and planned implementation of rate increases.

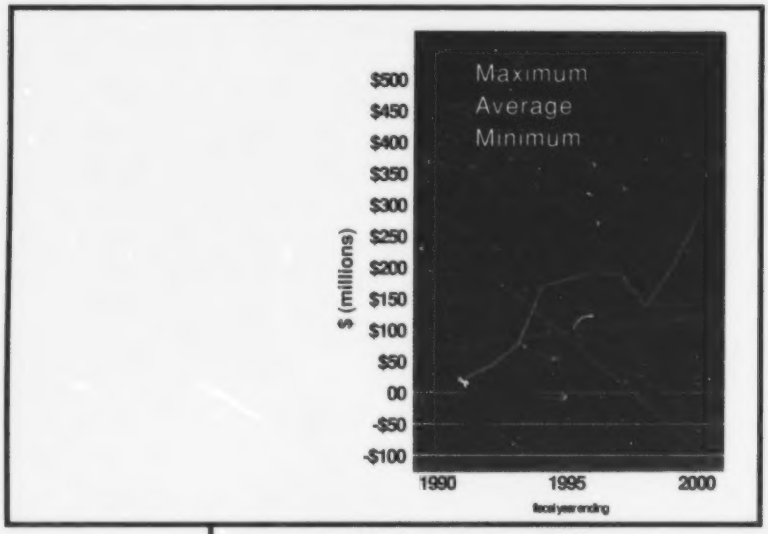


figure 7.4 ***Net Interchange Revenues***

Manitoba Hydro's reserves, in protecting against contingencies, play a significant role in ensuring rate stability and rate predictability. Without adequate reserves large fluctuations in rates would follow as the Corporation is forced to react to unexpected contingencies or the addition of new major facilities.

7.2.2 The Impact of Drought

Drought is the single event that has the greatest effect on Manitoba Hydro's finances. During years of average or better water conditions, energy surplus to Manitoba's needs and firm contract requirements is sold in extraprovincial markets, and the revenues are used to reduce charges to Manitoba customers. Under drought conditions, all or almost all of these extra-provincial sales, excluding firm contracts, are lost.

Also, in order to meet the energy requirements of Manitoba customers, Manitoba Hydro will purchase energy from neighboring utilities and utilize more costly thermal generation. The cost of both options greatly exceeds the cost of hydraulic generation. Also, although less significant, additional interest costs are incurred as inflows of cash are reduced and outflows accelerated.

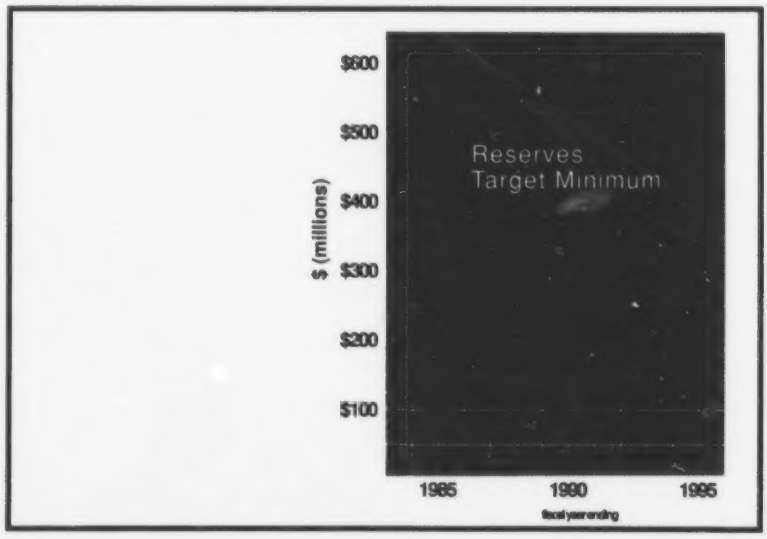
The additional costs are offset slightly by reduced water rental fees as hydraulic generation is reduced due to water conditions. In addition, Winnipeg Hydro shares in the increased costs through the cost-sharing agreement in force.

The flexibility to reduce costs during a drought is restricted. A large part of the Corporation's costs are essentially fixed in the form of interest payments, depreciation, lease payments, employee benefits, grants in lieu of taxes, etc. Although cost reduction measures are undertaken during drought periods, the impact is limited.

Figure 7.4 shows the Net Interchange Revenues associated with various flow conditions and in various years. Net Interchange Revenue is simply the total export revenue less any costs incurred for water rentals, imported energy, and thermal generation. The chart clearly indicates that low water conditions have a much larger impact than the potential increase in revenue of high water flows. This is due to two factors. Firstly, in high flow years, any net gain in revenue comes from the sale of surplus energy on the interruptible market, where the price/volume relationship means that high volumes result in lower prices; and secondly, water is spilled due to generating or transmission capacity limitations.

Figure 7.4 also indicates the growth from year to year in the costs of drought. For example, the estimated decrease in Net Interchange Revenue between average

figure 7.5 ***Reserve Levels***



and low flow conditions is approximately $80 million in 1990/91 and grows to approximately $150 million in 1996/97. In the later years, as the Manitoba firm load increases and more generating facilities are added, larger amounts of energy will be available for interruptible sales at average flows. Conversely, at low flows a greater volume of purchased energy or thermal generation may be required.

7.2.3 The Level of Reserves

Current financial forecasts indicate that rate increases closely aligned with projected rates of inflation will move Corporate reserves gradually towards the minimum reserve level target.

The minimum reserve target for any particular year is calculated as the sum of the differences between Net Interchange Revenue under average as opposed to lowest flow conditions for the next two succeeding years,plus an amount equal to the maximum loss the Corporation is liable to suffer under the self-insurance program. The Net Interchange Revenue difference serves as an approximation of the 1937-1941 drought, one of the worst droughts on record. For example, the drought portion of the minimum reserve target for 1989/90 is $170 million based on a revenue difference between average and low flows of about $80 to $90 million in each of the years 1990/91 and 1991/92. In later years, the possiblility of low water conditions results in a need for greater reserves. For example, the equivalent figure in 1996/97 is $320 million to cover potential shortfalls in 1997/98 and 1998/99.

The minimum reserve level targets are recalculated each year and may change slightly as assumptions relating to interruptible exports, prices of thermal generation and imports, and the potential self-insurance losses are revised.

Reserve levels as at March 31, 1989 were $92 million, well below the $210 million minimum target. Assuming average water conditions and assuming annual rate increases in the order of 4% to 6%, reserves are forecast to grow gradually until the cost of Limestone Generating Station is fully absorbed into the rate base. See Figure 7.5. From 1994/95 on, the impact of the Northern States Power sale produces both an increase in the level of the net revenues and correspondingly faster growth in reserves.

The term 'debt/equity ratio' is used to express the relationship between debt and equity in a corporation. It is simply the ratio of long-term debt compared to the corporation's reserves. Another frequently used term is 'gross interest coverage'. This is the ratio of gross interest plus net income to gross interest paid, and is one measure of a Corporation's ability to honor its interest payment commitments. Over the longer term, Manitoba Hydro has established a target of 85:15 for the debt/equity ratio, and a range of 1.15 to 1.25 for the gross interest coverage. The values at March 31, 1989 were 97:03 and 0.93 respectively.

With the assumptions detailed above, over the next ten years, Manitoba Hydro's debt/equity ratio should reach 85:15 (see Figure 7.6), and its gross interest coverage should be maintained at approximately 1.25.

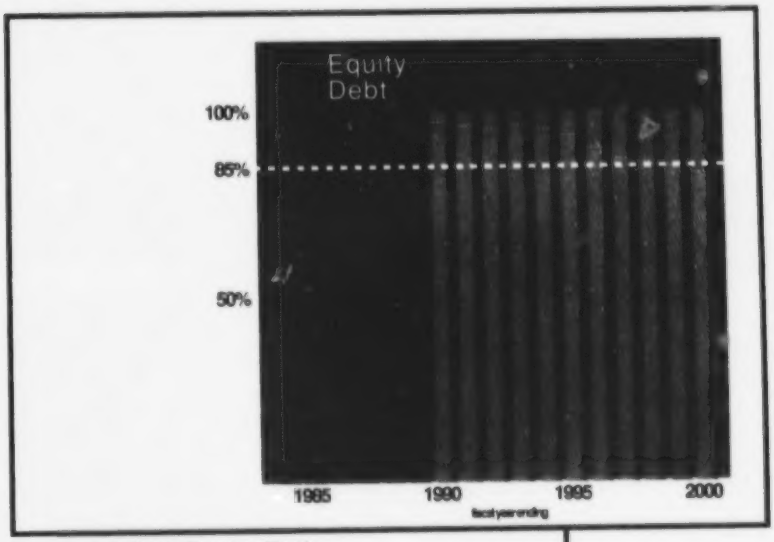


figure 7.6 ***Debt/Equity Ratio***

7.3 Financial Forecast

Every year, Manitoba Hydro prepares what is known as the Integrated Financial Forecast (IFF). This is a forecast of all capital and operating expenses and revenues over the next 20 years. All of the figures incorporated are estimates, and therefore very dependent upon the underlying assumptions. As conditions and assumptions change from time to time, so does the forecast.

The IFF serves as a tool for evaluating the impact of various decisions, and for helping to assure that the long term financial impact of current decisions is considered.

7.3.1 Integrated Financial Forecast

The current forecast was prepared in the fall of 1989, based on the then current assumptions and plans. In particular, these plans did not include the most recent agreements with NSP and UPA for the 150 MW diversity exchanges, or the 1000 MW sale agreement with Ontario Hydro. These contracts, which were agreed to after completion of the IFF, will have very little impact on the IFF prior to 2000. A new IFF will be prepared once the contracts have been ratified.

The current forecast includes capital expenditures, operating expenses and expected revenues for the period 1989 to 2009. It is considered that predictions more than a few years ahead are extremely speculative, so only the first 10 years are considered in Perspective 2000.

Figure 7.7 shows the operating results expected to be achieved under the assumed conditions up to and including the year 2000.

Figure 7.8 shows the estimated annual capital expenditures in both current (i.e. in the year in which they are spent) and constant (i.e. adjusted to the equivalent value in a single year) dollars. The effects of the subsequently contracted diversity exchanges with NSP and UPA and of the 1000 MW firm sale to Ontario Hydro would be negligible in Figure 7.7, and in Figure 7.8 would move the increase starting in 1996 out to 1997.

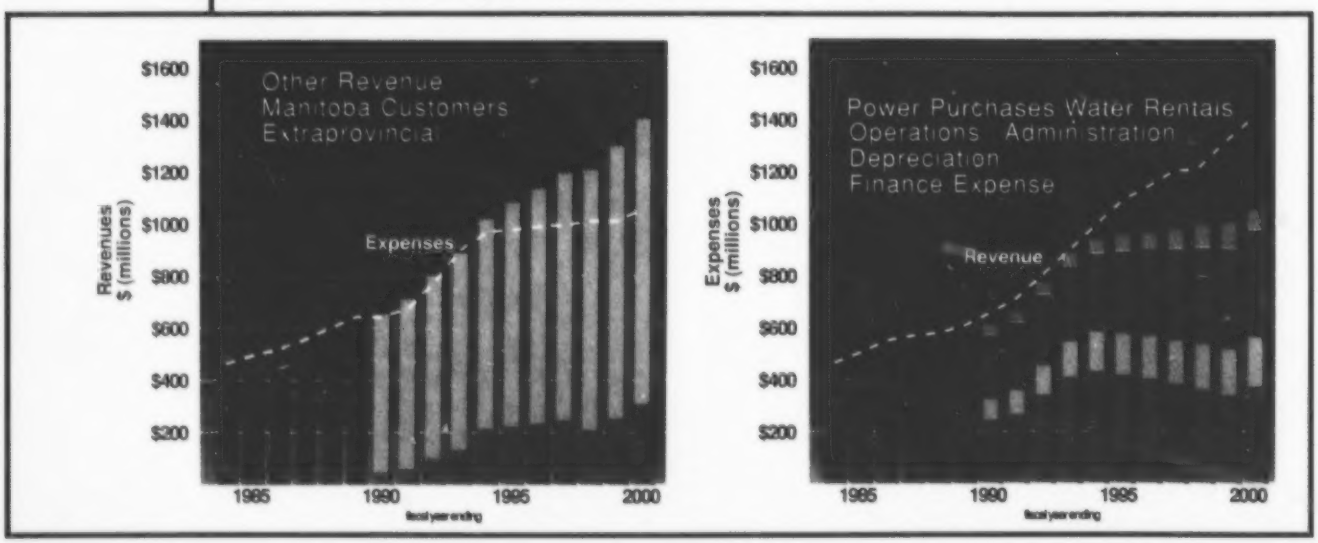
7.3.2 Key Assumptions

The IFF incorporates several key assumptions which inherently will be reflected in the results produced. The key assumptions used include:

Load Growth

The 1989 load forecast, which shows a 10 year growth rate of 2.7% per year.

figure 7.7 ***Projected Operating Results***



Capital Forecast

In-service dates for major generation and transmission facilities as follows:

Hydro Generation	(1st Unit)
Limestone	1990 11 15
Conawapa	1999 10 01
Wuskwatim	2012 10 01
Transmission	
Limestone Transmission (first I.S.D.)	1990 11 15
Conawapa Transmission (first I.S.D.)	1999 10 31
Riel - St. Vital Transmission	1999 10 01
HVDC Conversion Bipole III	1999 10 01
Winnipeg - Brandon 500 kV Transmission	1999 10 31

These in-service dates do not consider the effect of the subsequent contracts with Ontario Hydro, NSP and UPA. As discussed elsewhere, the net effect of these agreements would be to delay the in-service dates of Conawapa and Bipole III by a year.

Winnipeg Hydro

The current Winnipeg Hydro cost-sharing agreement is in force until March 1990. For financial forecasting purposes it was assumed to be renewed under the same terms and conditions.

Water Conditions

The generation cost and revenue estimates were forecast based on actual reservoir conditions on June 15, 1989, and on median precipitation thereafter. Inflows to major reservoirs, including Lake of The Woods, the Winnipeg River, Lake Winnipeg, the Saskatchewan River Basin, the Churchill River and the Nelson River, were assumed not to return to normal until 1990/91. The Churchill River Diversion was assumed to continue to operate under both a summer and winter augmented flow program.

Extraprovincial Sales

Estimates of extraprovincial sales include estimated revenue from the NSP 500 MW and Ontario Hydro 200 MW sales. These are assumed to be 'designated' sales under the Manitoba Energy Foundation Act (MEFA) and as such revenues are projected with a 50:50 sharing, with the Province, of sales in excess of costs. If MEFA were to be repealed, it would result in approximately an additional $245 million revenue to the Corporation.

Estimated revenue from interruptible sales to all purchasers is also included.

Interest, Escalation and Foreign Exchange Rates

The interest, escalation and U.S. exchange rates used in the forecast were:

Fiscal Year	Interest	Escalation	U.S. Dollar
1989/90	10.5%	4.5%	$1.20
1991/90	10.0%	4.5%	$1.22
1991/92	10.5%	5.0%	$1.22
1992/93 & on	10.5%	5.0%	$1.25

Government Assessments

It was assumed that government assessments such as sales taxes, duties, grants in lieu of property tax, water rentals, and so on, would remain generally the same as now. The effects of the proposed Federal Goods and Services Tax have not been incorporated.

General Consumer Rate Increases

For the purposes of financial planning, rate increases were assumed as follows:

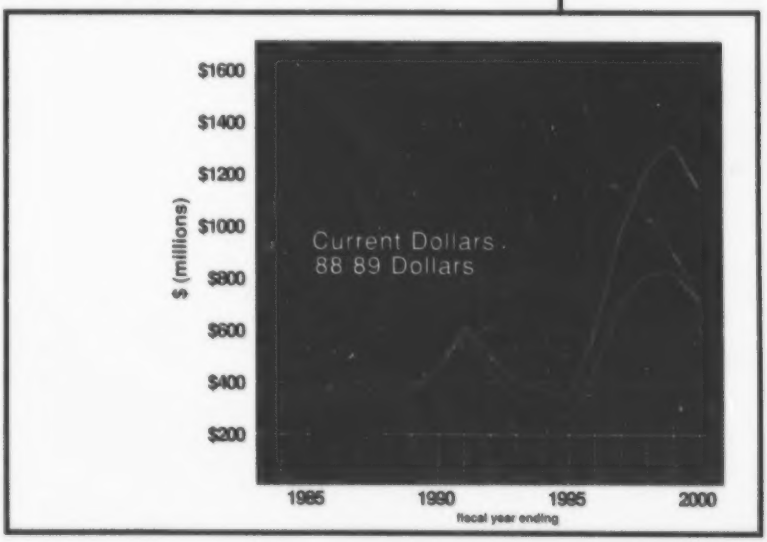
1990/91	4.5%
1991/92	5.0%
1992/93	5.0%
1993/94	5.0%
1994/95	5.0%
1995/96 on...	3.0%

Only the 4.5% increase for 1990/91 has been approved for implementation by Manitoba Hydro. Rate increases beyond this may not represent the future of electricity rates.

7.3.3 Sensitivity to Assumptions

A deviation from any of the assumptions will result in a different forecast. The areas of greatest concern to Manitoba Hydro are the possibility of recurring drought and the possibility of deterioration of economic conditions throughout Canada. Also of significant concern is the possibility that domestic rate increases and surplus energy prices might be less than assumed. On the other hand, deviations in these, and other items, in the opposite direction would have favorable results for the Corporation.

figure 7.8 ***Capital Expenditures***



7.4 Borrowing Requirements

In order to finance its capital programs, Manitoba Hydro must borrow and repay maturing debt. Because interest on this debt represents the biggest single expense the Corporation faces, a comprehensive financial management program is essential.

7.4.1 Funds Required

The amount of money that must be borrowed varies from year to year, depending upon the capital program, maturing debt, and internally generated funds. Figure 7.9 shows the net annual borrowing expected until 2000, based on the 1989 Integrated Financial Forecast. Naturally, any deviation from this forecast will change the borrowing requirements.

Ratification of the NSP and UPA diversity exchanges and the 1000 MW Ontario Hydro sale would defer the major borrowing program shown commencing in 1996/97 by one year.

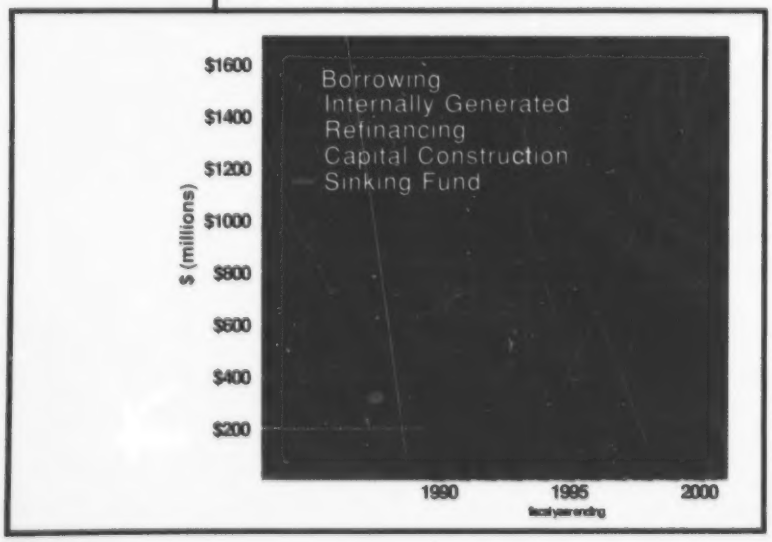
7.4.2 Sources of Funds

Funds for Manitoba Hydro's purposes are either borrowed directly by Hydro, or borrowed on the Corporation's behalf by the Province. Loans, usually in the form of bonds, are mostly denominated in Canadian and U.S. currencies.

To date, Hydro has had little difficulty in raising the necessary funds at reasonable interest rates, and expects to be able to continue to do so. This assumes that there is no major worldwide financial crisis, and that the Province of Manitoba maintains or improves its credit rating.

Potential foreign exchange losses are a major concern to the Corporation. Consequently, it has adopted an "Exposure Management Program" to deal with the

figure 7.9 ***Sources and Application of Funds***



financial impact and risk levels of foreign exchange exposure.

Energy sales to U.S. utilities are priced and paid in U.S. dollars, while interest and principal payments on U.S. bonds are also paid in U.S. dollars. The Exposure Management Program is designed to offset these U.S. dollar cash flows, and limit the net U.S. dollar exposure to an amount that does not exceed 20% of the total long term debt outstanding.

In the long run, projected U.S. revenues from firm export contracts will be more than adequate to fully offset all outstanding U.S. debt principal repayments. Firm U.S. revenues plus a conservative projection for U.S. revenues from surplus energy sales will also partially offset U.S. interest payments. The resulting difference will be a net U.S. dollar exposure that is well within the Corporation's financial capability.

In order to satisfy the objective of long-term, low-cost financing for its activities, Manitoba Hydro uses the following guidelines:

1) Long-term fixed rate financing for maturities of 10 to 30 years is arranged when market rates and conditions are attractive.

2) Floating rate or short-term fixed rate financing is arranged when market rates and conditions are not attractive for long-term fixed rate financing or when required to address foreign exchange exposure management objectives.

3) All long-term financing is arranged in Canadian or U.S. dollars within the exchange exposure management policy limitations.

4) The availability and applicability of non-traditional forms of financing are considered (e.g. project financing, trade financing, leasing, Hydro Savings Bonds, etc.).

Short term investments form an integral part of the long term financing strategy and generally result from borrowing in advance of requirements. The short term investment strategies are therefore focused on interest rate forecasts and the ability to meet cash requirements in a cost effective manner.

Manitoba Hydro expects that its average cost of financing over the long term will be in the range 10% to 10.5%.

In order to be ready to meet the demands of the future, Manitoba Hydro must take some action today.

Actions must be based on predictions made in situations of great uncertainty. One of the biggest challenges is to retain both sufficient certainty to function effectively and efficiently, and sufficient flexibility to adjust when the future turns out to be different from what had been forecast.

8.1 The Perils of Predictions

All of the Corporation's plans must be based on estimates of future events. There can be a wide variety of opinions as to what the future may hold. Past events and relationships can sometimes be used as a guide, but there is no guarantee that the future will emulate the past.

Also, the further into the future predictions must be made, the less confidence they can inspire.

Unfortunately, Manitoba Hydro's major investment decisions involve situations that do not come into effect for 7 to 10 years in the future, and involve facilities that are planned to return that investment over a further 60 to 100 year period.

Manitoba Hydro must make these types of decisions. It must therefore make predictions as to the future, and it does so after much research and analysis. But it also does so in the sure knowledge that not all of its forecasts will be perfect.

8.1.1 Predictions Made

Predictions have to be made in a variety of fields. These have all been described more thoroughly in other sections of Perspective 2000. The most important factors are included in four main groupings.

Economic Factors—interest rates, inflation rates, economic growth, population growth, household formation, and so on.

Consumer Behavior—consumption patterns, lifestyles, energy preferences, legislation and regulation, and so on.

Facilities Performance—reliability, efficiency, and deterioration rates.

Competition—availability and price of other forms of energy.

In each case, a best estimate or base case prediction is made.

8.1.2 Scenarios

It matters not so much that a prediction may be "wrong"—it probably is. The real issue is how much can it be wrong before it becomes significant, and what can be done to minimize the effects of being wrong.

Several techniques are used. A great deal of sophisticated analysis is performed, but the most valuable tools are the expedients of comparing scenarios and constantly re-evaluating.

Given the best estimate of the future, a base case scenario is constructed. (This is the one that is primarily

considered in Perspective 2000.) Then various combinations of other estimates are used to construct alternative scenarios.

The base case scenario becomes the driving force. All activities and actions are scheduled and undertaken to satisfy the timetable associated with this scenario.

To some extent the timetables associated with other scenarios can be protected by undertaking the required activities. There comes, however, a point where an action or lack thereof effectively forecloses on the options related to another scenario.

The whole forecasting and planning exercise is repeated annually. This ensures that changing trends, unexpected occurrences, new knowledge and current experience is all brought into the equation as soon as they are identified, and a new base case scenario is developed.

For example, all the predictions contained in Perspective 2000 are based in part on a forecast of economic factors that was prepared in early 1989. This forecast is now under review since a new one will be prepared for early 1990, and a new round of forecasts and plans will again be started.

Similarly, while Perspective 2000 discusses the development sequence associated with the most recent agreements for export arrangements with Ontario Hydro, NSP and UPA, it also includes financial information based on the 1989 IFF. This forecast was prepared prior to theses agreements being reached, and will be reviewed once the contracts are ratified by the appropriate authorities.

8.2 Major Corporation Decisions

Given the fact of an uncertain future, it can be instructive to look at the major decisions the Corporation must make, the potential ramifications of these decisions, and what can be done to reduce the risk.

8.2.1 New Facilities

Undoubtedly the most important decisions the Corporation makes are those pertaining to new major generating and transmission facilities. The choice of in-service date is at least as critical as the selection among competing options.

The risks are that a plant is committed for an in-service date that subsequently proves to be either too soon, or too late. If too soon, the worst that can happen is that the plant would be completed prior to its output being required. Any energy that it delivered could probably be sold on the interruptible market, but it is unlikely that the revenue would cover the entire cost of the plant. Alternatively, once it became apparent that a later in-service date would be acceptable, the construction program could be slowed down and the in-service date delayed. This would probably result in increased construction costs. Either way, Manitoba Hydro's customers would wind up having to pay more than the optimum amount.

If the in-service date is too late, then the risk is that the province would be short of power. This would be in contravention of the Manitoba Hydro Act. Again Manitoba Hydro would normally identify the problem before this happened, and would normally be able to avoid it. Depending upon the circumstances, construction of the plant could be accelerated, and/or an emergency arrangement could be made with a neighboring utility, and/or gas turbines could be installed, and/or load reduction or load shedding programs could be implemented. All of these would again result in greater cost and/or reduced service levels to Manitoba customers.

It would be better to err on the side of being early, in that this assures the Corporation's ability to provide for the continuance of electrical power to satisfy its customers' needs.

Similarly, a plant selected as being optimum under a given set of assumptions may turn out to be the 'wrong' option if the circumstances change. In this case, the effects are financial, and while some actions can be taken to respond to the changes and to mitigate the losses, the net result would be greater than optimum costs to Manitoba customers.

8.2.2 Rates

The second-most important decisions are those related to establishing rates to be charged to Manitoba customers.

Since rates can in theory be changed at any time, and in practice are usually adjusted every year, it is apparent that an over or undercharge can be fairly readily corrected. However, an inconsistent rate strategy can be confusing to consumers, so it is important that rates be set at the appropriate level.

If they are too high, consumers would be unnecessarily penalized, the competitiveness of local business could be diminished, and economic development opportunities could be missed.

If they are too low, customers may not be persuaded to conserve energy appropriately, and the accompanying financial strain on the Corporation would reduce its ability to provide essential services and maintain and replace its equipment.

AMP: (ampere) A unit of measurement of electric current. One amp is the current drawn by an appliance rated at 120 watts operating at a voltage of 120 volts. For example, a 100 watt light bulb will draw a current of 0.8 amps. A typical domestic clothes iron draws about 8 amps.

CAPACITY: The greatest load which a unit, station or system can supply. Capacity is usually measured in kilowatts, megawatts, or larger units. (See POWER UNITS.)

CAPACITY FACTOR: The ratio of the average load supplied by a unit, station or system compared to the capacity of that facility.

For example, a 20 per cent capacity factor in an export agreement for 100 MW means that the average export will be 20 MW, and that at any given moment, it would vary from zero to 100 MW.

COGENERATION: The generation of electricity in conjunction with the production of useful heat, usually steam, for industrial purposes. Where an industrial firm wishes to generate both steam and electricity, it may be more energy efficient and cheaper to generate the two together rather than separately, or to generate steam and buy electricity. Cogeneration plants are usually fueled by oil, natural gas, wood, or other organic waste.

CONSERVATION: The wise use of all resources including increasing efficiency of use, reducing consumption of scarce resources, and reducing waste. Energy conservation may mean using more of one type of energy efficiently to replace an inefficient use of another, resulting in an overall reduction in energy use. Thus, energy conservation and electricity use reduction are not necessarily synonymous.

DEMAND (1): In economics, the desire of purchasers for a commodity, usually inversely related to price. Demand for electricity also varies with time of day, season and economic conditions.

DEMAND (2): In the electrical industry, "demand" is often used synonymously with "power" or "load" which is the rate at which electric energy is delivered at a given instant or averaged over some designated period of time. It is expressed in kilowatts, megawatts, and other larger units (see POWER UNITS).

DEMAND MANAGEMENT: Actions taken by a utility or other agency intended to influence the amount or timing of customers' use of electricity. These actions can be divided into three groups: load growth; load shifting; and load reducing. Also known as Demand-Side Management.

DEMAND/SUPPLY OPTION: This term is used to describe techniques or programs which could be used to meet future electrical needs. Demand options are those which could be used to reduce electrical needs or the rate of growth of those needs. Supply options are additional generating plants or improvements to existing plants.

DISTRIBUTION SYSTEM: Facilities (lines, transformers, switches, and other electrical apparatus) used to distribute electricity over short distances from the transmission system to customers. Distribution is generally at relatively low voltages (33 kV and less).

DIVERSITY EXCHANGE: An arrangement that allows a summer peaking utility (for example, Northern States Power) to draw capacity and energy from a winter peaking utility (for example, Manitoba Hydro) in the summer period. The winter peaking utility then draws it back in the winter. The arrangement results in lower capacity requirements for both utilities.

DUAL-HEATING SYSTEM: A heating system that can use two different fuel sources.The selection between fuels may be controlled by either the consumer or the supplier, with prices being established accordingly. In Manitoba, the most frequent type is one which uses both wood and electricity, with the selection being controlled by the consumer.

ELECTROTECHNOLOGY: A technology that uses electricity in its processes, especially new applications of electricity, including those that displace the use of other energy sources: for example, the use of microwave ovens for rendering animal products instead of air heated by on-site fuel combustion.

ENERGY: The ability to do work. Electric energy, the product of power and the time over which it is used or produced, is commonly measured in kilowatt hours. Another measure often used to compare energy from different sources, is the joule (see ENERGY UNITS).

ENERGY UNITS:

JOULE (J): An extremely small unit of measure of energy.

MEGAJOULE (MJ): A small unit of measure of energy, equal to 1 000 000, or 10^6 Joules. 1 MJ is equivalent to 0.28 kW.h.

WATT HOUR (W.h): A small unit of measure of electrical energy. One watt hour is the energy used in one hour by a device that uses one watt of power. For example, a 100 watt light bulb will use 100 watt hours if left on for one hour. Similarly, a 50 watt bulb must be left on for two hours for it to consume 100 watt hours of energy. The watt hour is usually augmented by a prefix to create more practical, larger units:

Prefix	Abbreviation	Multiplier
kilo	k	10^3 or 1 000
mega	M	10^6 or 1 000 000
giga	G	10^9 or 1 000 000 000
tera	T	10^{12} or 1 000 000 000 000

KILOWATT HOUR (kW.h): One kilowatt hour equals 1 000 watt hours. Ten 100 watt light bulbs or a typical clothes iron would consume one kW.h if left on for one hour. The kilowatt hour is the unit of measure of energy which may be most familiar to customers, as it is the unit appearing on electricity bills.

MEGAWATT HOUR (MW.h): One megawatt hour equals one million watt hours or one thousand kilowatt hours. A typical residence in Manitoba using electricity for space and water heating uses approximately 30 MW.h per year.

GIGAWATT HOUR (GW.h): One gigawatt hour equals one billion watt hours or one million kilowatt hours. A typical Manitoba manufacturing plant uses between 10 and 30 GW.h per year.

TERAWATT HOUR (TW.h): One terawatt hour equals one billion kilowatt hours. Total electrical energy consumed in Manitoba is about 17 TW.h per year.

ENERGY SERVICE: The task performed by energy. Some services are commonly fueled by only one energy type, while others may use a variety. For example, storage of perishable food is a service usually provided by refrigerators run by electricity. Cooking may employ natural gas or electricity while space heating can be provided by electricity, natural gas, oil, or a variety of other energy sources.

FIRM LOAD: The load which a utility is committed to meeting either through implicit or explicit contract arrangements. The energy requirements of all Manitoba customers are considered to be part of the firm load unless specific arrangements are made otherwise.

FIRST ENERGY BLOCK: The first price block of energy in a stepped block rate structure. It is common to charge one rate for the first block of kW.h and a different rate for the balance.

FREQUENCY: The rate at which alternating current changes direction. In North America this rate is 60 cycles per second (known as 60 cycles). It is not technically feasible to maintain the frequency at exactly 60 cycles but it is possible to maintain it within a close range. The majority of appliances will work adequately between 59 and 61 cycles. Any variation beyond this could cause the appliance to malfunction and in some cases could be dangerous.

GENERATING UNIT: A generator together with the device turning it. A generating unit can usually operate independently of other units in a multi-unit generating station.

GIGAWATT (GW): (see POWER UNITS)

GIGAWATT HOUR (GW.h): (see ENERGY UNITS)

GREENHOUSE EFFECT: The warming of the earth due to the retention of long wave radiation. Certain gases, primarily carbon dioxide, caused by combustion processes and natural decay, build up in the atmosphere at rates greater than the gases can be re-absorbed (as in photosynthesis). These gases reflect back to the earth the long wave radiation that would normally escape with the net result that the overall temperature of the earth is increased.

GROSS PROVINCIAL PRODUCT (GPP): The annual total value of goods and services produced within a provincial economy. In Perspective 2000 it refers to the Province of Manitoba. (Also known as Gross Domestic Product or GDP.)

INDEPENDENT POWER PRODUCTION: Generation owned or operated by producers other than a utility, and which is greater than the producer's own needs and is offered for sale to the utility.

INTEGRATED FINANCIAL FORECAST: The Integrated Financial Forecast indicates the projected Financial results of the Corporation under specified assumptions. The forecast is integrated in that each part of the organization estimates on a consistent and comparable basis with both capital construction plans and operating costs being taken into consideration.

INTERRUPTIBLE RATE: A discounted rate available to large industrial or extraprovincial customers who agree to have their electrical service interrupted or reduced during times when energy is not available.

JOULE(J): (see ENERGY UNITS)

KILOWATT (kW): (see POWER UNITS.)

KILOWATT HOUR (kW.h): (see ENERGY UNITS.)

LOAD: (see DEMAND (2))

LOAD FACTOR: The ratio of the average load supplied by a unit, station or system compared to the peak load.

For example, if an industry used an average of 100 kW during a 24-hour period, but at one point during the day they were using 200 kW, then the load factor for that day would be 50%.

LOAD SHAPE: A term describing the graph pattern of electricity use or production when demand is plotted against time (also known as load profile, load curve).

LOAD SHIFTING: The shifting of electrical demands from one period to another, usually from high load to low load periods. Load shifting may result from direct control of customers' loads by the utility or from rate or other financial incentives.

MARGINAL COST: Marginal cost refers to the change in total cost incurred to provide for an additional unit of output. Marginal costs can be either short or long run. Short run refers to the change in cost for a short period of time during which the system capacity can not be altered. Long run refers to an extended period of time during which system capacity can be altered.

MARGINAL COST BASED RATES: Rates based on the marginal cost of operating a system, or the marginal cost of expanding the system. Marginal cost based rates are usually, although not always, higher than rates based on average costs.

MEGAJOULE (MJ): (see ENERGY UNITS)

MEGAWATT (MW): (see POWER UNITS.)

MEGAWATT HOUR (MW.h): (see ENERGY UNITS)

NET PRESENT WORTH: Refers to the present earning value of revenues and expenses which are anticipated to occur in the future. Also known as "net present value".

PEAK DEMAND: The maximum rate of energy consumption that occurs within a given period of time. Peak demand can refer to the maximum demand placed on a system as a whole, or individual parts of a system, or individual customers, or applications. In 1989 the peak demand on the Manitoba Hydro system was 3.4 GW. (Also known as "system peak"; see POWER UNITS.)

PEAKING CAPACITY: Generating stations which are normally operated only to provide power during maximum load periods. Also known as "peaking plant".

POSTAGE STAMP RATES: Rates based on principles used in designing rates for postal service. The most significant characteristic is that the charge for a particular type of service is the same regardless of geographic location or customer density. Applied to electric utilities, it means that all customers in a particular rate classification, throughout the utility's franchise area, pay the same rate regardless of the cost to serve the class.

POWER: The rate at which electric energy is delivered. It is expressed in kilowatts, megawatts, and other units of power. (See POWER UNITS.)

POWER UNITS:

WATT (W): A small unit of measure of power. The typical light bulb uses power at a rate of 100 watts. The watt is usually augmented by a prefix to create a more practical, larger unit:

Prefix	Abbreviation	Multiplier
kilo	k	10^3 or 1 000
mega	M	10^6 or 1 000 000
giga	G	10^9 or 1 000 000 000

KILOWATT (kW): One kilowatt equals 1000 watts. Ten 100 watt light bulbs would use one kW, as would a typical clothes iron or a large hair dryer. An electrically heated house would use about 10 kW.

MEGAWATT (MW): One megawatt equals one million watts or one thousand kilowatts. For example, 100 electrically heated houses would use about one megawatt as would a small industrial customer. The peak demand on the Manitoba Hydro system is about 3 400 megawatts.

GIGAWATT (GW): One gigawatt equals one billion watts or one million kilowatts. The peak demand on the Manitoba Hydro system is about 3.4 GW.

RESERVE CAPACITY: The amount by which total system capacity exceeds the peak demand within a given period of time. Some reserve is required to maintain system reliability in anticipation of unexpected high demands or equipment failures. Planning reserve is the amount by which system capacity is planned to exceed forecast annual peak demand. The absolute amount of reserve capacity is usually expressed in MW; when expressed as a percentage of expected peak demand, the term "reserve margin' usually applies.

SELF-GENERATION: The generation by a customer to supply all or part of their own electricity requirements.

SOCIAL RESPONSIBILITY RATES: Rate forms or rate policies which, by intent, give explicit subsidies to certain groups of customers to achieve particular social welfare objectives.

SUPPLY MANAGEMENT: Actions taken by a utility to satisfy the customer's requirements for energy. It is usually referred to in counterpoint to the term demand management (or demand-side management).

SUSTAINABLE DEVELOPMENT: The concept that there is a limit to which the earth's resources can be exploited before the adverse effects of this exploitation become unacceptable. The limit may be quantity or method or a combination. Sustainable development implies equilibrium between economic development, energy consumption, and environmental impacts.

TAIL ENERGY BLOCK: The last price block of energy in a stepped block rate structure.

TERAWATT HOUR (TW.h): (see ENERGY UNITS)

TIME-DIFFERENTIATED RATES: (see TIME-OF-USE-RATES)

TIME-OF-USE RATES (TOU): Rates that vary based on the time of day, day of the week, or season of the year. The rationale for TOU rates is that costs to producing electricity vary somewhat over the hours of the year. Time-differentiated rates are an attempt to signal this variation in costs.

TRANSMISSION SYSTEM: Facilities (lines, transformers, switches, and other electrical apparatus) used to transport electricity in bulk from sources of supply to other principal parts of the system. Transmission is generally at a higher voltage — 115 kV and above.

VOLTAGE: The measure of the electrical potential in a conductor. Voltage is comparable to the pressure in a pipe in that it is the force that moves the current through the wire. Electricity can be supplied at many different voltages. Typical household appliances use 120 or 240 volts, but industrial uses may require up to 5000 volts. It is not technically feasible to maintain the voltage at exactly 120 volts (or any other value). It is possible to maintain it within a certain range however, and appliances are designed to operate within this range. For example, household appliances work well between 110 and 125 volts. Any variation beyond these acceptable ranges can cause the appliance to malfunction which in some cases could be dangerous.

WATT (W): (see POWER UNITS)

WATT HOUR (Wh): (see ENERGY UNITS)

WEATHER ADJUSTMENT: A statistical adjustment made to actual peak demand or to actual energy consumption, to bring it into line with what would have occurred under normal weather conditions. It is a technique for removing the impact of weather variations from studies of load growth.